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South Manti Timber Salvage Draft Environmental Impact Statement

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United States
Department of
Agriculture

Forest Service

Intermountain
Region

Manti-La Sal
National
Forest

Ferron-Price and
Sanpete
Ranger
Districts

1999



0080-F A13.92/2:M31/5

South Manti Timber Salvage

Draft Environmental Impact Statement

Comments are requested on the contents of this document.

Reviewers should provide the Forest Service with their comments during the review period of the Draft Environmental Impact Statement. This will enable the Forest Service to analyze and respond to the comments at one time and use information acquired in the preparation of the Final Environmental Impact Statement, thus avoiding undue delay in the decisionmaking process. Reviewers have an obligation to structure their participation in the National Environmental Policy Act process so that it is meaningful and alerts the agency to the reviewers' positions and contentions. *Vermont Yankee Nuclear Power Corp. v. NRDC*, 435 U. S. 519, 533 (1978). Environmental objections that could have been raised at the draft stage may be waived if not raised until after completion of the Final Environmental Impact Statement. *City of Angoon v. Hodel* (9th Circuit, 1986) and *Wisconsin Heritages, Inc. v. Harris*, 490 F. Supp. 1334 (E. D. Wis., 1980). Comments on the Draft Environmental Impact Statement should be specific and should address the adequacy of the statement and merits of the alternatives discussed (40 CFR 1503.3).

Comments received in response to this solicitation, including names and addresses, will be considered part of the public record and will be available for public inspection. Comments submitted anonymously will be accepted and considered; however, those who submit anonymous comments will not have standing under Title 36 of the Code of Federal Regulations Parts 215 or 217, regarding that submission of comments. Additionally, pursuant to Title 7 of the Code of Federal Regulations Part 1, section 27(d), any person may request that a submission be withheld from the public record by showing how the Freedom Of Information Act permits such confidentiality. Persons requesting such confidentiality should be aware that confidentiality is granted in only very limited circumstances, such as to protect trade secrets. The Forest Service will inform the requester of its decision regarding a request for confidentiality, and where the request is denied, the Forest will return the submission and notify the requester that the comments may be resubmitted with or without name and address.

Those who do not respond to this solicitation of comments, or otherwise provide notice of their continued interest, will not receive the resulting Final Environmental Impact Statement or Record of Decision.

99-031339

C-1

C-2



File Code: 1950
Date: April 19, 1999

Dear Interested Party:

Enclosed for your review and comment is the South Manti Timber Salvage Draft Environmental Impact Statement (DEIS), prepared by the Manti-La Sal National Forest.

This project was initiated in response to epidemic spruce beetle activity across the South Manti landscape. Representing over 10,000 acres, most of the spruce trees in the project area's Engelmann spruce-Subalpine fir cover type are dead or dying. The DEIS summarizes the analysis that was completed on the resulting alternatives considered for timber salvage harvest and related activities such as road work, road rehabilitation, and reforestation. Additionally, disclosure is made on the association of each alternative to the Agency's final interim rule of March 1, 1999, which temporarily suspends decisionmaking on road construction and reconstruction in many unroaded areas within the National Forest System until a revised policy is issued or 18 months from the effective rule date, whichever is sooner. The disclosure of information in the DEIS is intended to provide a meaningful basis for public review and comment.

None of the alternatives are currently identified as the "preferred" alternative. Each alternative represents a different scenario for management with correspondingly different effects. Your alternative-specific comments will help in making the final decision. The final decision will reflect Agency policy in effect at the time of decision.

Comments¹ on the draft statement must be postmarked or received at the above address by June 28, 1999.

All timely comments will be considered in the Final Environmental Impact Statement. It is most helpful if comments are as specific as possible and include reference to applicable sections or pages in the draft statement. It would also be helpful to know the reason for your comment.

Those who do not respond to this solicitation of comments, or otherwise provide notice of their continued interest, will not receive the resulting Final Environmental Impact Statement or Record of Decision.

Any questions about this project should be directed to Don Fullmer, Ecosystem Management Branch Chief, at the office location indicated on the letterhead.

Sincerely,


JANETTE S. KAISER
Forest Supervisor

enclosure

¹ Reviewers should provide the Forest Service with their comments during the review period of the Draft Environmental Impact Statement. This will enable the Forest Service to analyze and respond to the comments at one time and use information acquired in the preparation of the Final Environmental Impact Statement, thus avoiding undue delay in the decisionmaking process. Reviewers have an obligation to structure their participation in the National Environmental Policy Act process so that it is meaningful and alerts the agency to the reviewers' positions and contentions. Vermont Yankee Nuclear Power Corp. v. NRDC, 435 U.S. 519, 533 (1978). Environmental objections that could have been raised at the draft stage may be waived if not raised until after completion of the Final Environmental Impact Statement. City of Angoon v. Hodel (9th Circuit, 1986) and Wisconsin Heritages, Inc. v. Harris, 490 F. Supp. 1334 (E.D. Wis., 1980). Comments on the Draft Environmental Impact Statement should be specific and should address the adequacy of the statement and merits of the alternatives discussed (40 CFR 1503.3).

Comments received in response to this solicitation, including names and addresses, will be considered part of the public record and will be available for public inspection. Comments submitted anonymously will be accepted and considered; however, those who submit anonymous comments will not have standing under Title 36 of the Code of Federal Regulations Parts 215 or 217, regarding that submission of comments. Additionally, pursuant to Title 7 of the Code of Federal Regulations Part 1, section 27(d), any person may request that a submission be withheld from the public record by showing how the Freedom Of Information Act permits such confidentiality. Persons requesting such confidentiality should be aware that confidentiality is granted in only very limited circumstances, such as to protect trade secrets. The Forest Service will inform the requester of its decision regarding a request for confidentiality, and where the request is denied, the Forest will return the submission and notify the requester that the comments may be resubmitted with or without name and address.

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South Manti Timber Salvage Draft Environmental Impact Statement

Manti-La Sal National Forest
Ferron-Price and Sanpete Ranger Districts
Sanpete and Sevier Counties, Utah

April 1999

RESPONSIBLE AGENCY: USDA Forest Service, Intermountain Region

RESPONSIBLE OFFICIAL: Forest Supervisor, Manti-La Sal National Forest
599 West Price River Drive
Price, Utah 84501

CONTACT FOR MORE INFORMATION: Don Fullmer at the above address or phone number (435) 637-2817.

ABSTRACT:

The South Manti project area is located approximately 45 miles southwest of Price, Utah. The project area consists of approximately 24,597 acres of National Forest System lands within the southern portion of the Wasatch Plateau (Townships 19, 20, and 21 South; Range 4 East; SLM).

This project was initiated in response to epidemic spruce beetle (*Dendroctonus rufipennis*) activity across the South Manti landscape. Extensive Engelmann spruce mortality has occurred as the result of epidemic spruce beetle populations. Representing over 10,000 acres, most of the spruce trees in the project area's Engelmann spruce-Subalpine fir cover type are dead or dying (70% of the spruce trees greater than 5 inches in diameter are dead, 90% of the spruce trees greater than 11 inches in diameter are dead). This Draft Environmental Impact Statement summarizes the analysis that was completed on the resulting alternatives considered for timber salvage harvest and related activities such as road work, road rehabilitation, and reforestation in the project area. This Draft Environmental Impact Statement also discloses the association of each alternative to the Agency's final interim rule of March 1, 1999, which temporarily suspends decisionmaking on road construction and reconstruction in many unroaded areas within the National Forest System until a revised policy is issued or 18 months from the effective rule date, whichever is sooner. The disclosure of information in the Draft Environmental Impact Statement is intended to provide a meaningful basis for public review and comment.

The purpose and need of this project is to address ecological and economic values affected by spruce beetle activity in the South Manti project area as defined below.

1. Reduce potential for large and intense wildfires across forested areas (with associated environmental effects).
2. Facilitate rapid reestablishment of Engelmann spruce through replanting in Timber Emphasis Units identified in the Forest Plan.
3. Recover some of the economic value of dead and dying trees.

Four alternatives, including a no action alternative, were considered in detail to meet the purpose and need of the project and respond to significant issues. The four alternatives considered in detail are summarized below, and are presented in Chapter 2 of the Draft Environmental Impact Statement (detailed descriptions are on pages 2-7 through 2-13, maps are on pages 2-21 through 2-27).

1. **Alternative 1** is the no action alternative. Under this alternative, no new activities would be initiated in the project area from this planning effort at this time. Many valuable aspects of the purpose and need would be foregone.
2. **Alternative 2** proposes salvage harvest of dead and dying spruce trees across 6,530 treatment acres outside and within inventoried roadless areas (RARE II and Forest Plan). Approximately 3,988 treatment acres are outside of inventoried roadless areas, 1,070 treatment acres are within RARE II inventoried roadless areas, and 1,472 treatment acres are within a Forest Plan inventoried roadless area (Heliotrope). Past experience indicates that 50 to 65 percent of the treatment area is likely to be harvested (3,200 to 4,200 acres). This alternative does not include road construction or reconstruction in RARE II inventoried roadless areas. It does include road construction (1.1 miles) and road maintenance (0.8 miles) in the Forest Plan inventoried roadless area (Heliotrope). It also includes approximately 15 miles of Forest Development Road reconstruction and 8 miles of temporary road construction followed by reclamation. This alternative includes Forest Development Road, nonsystem road, and motorized trail reclamation within (4 miles) and outside (18 miles) of inventoried roadless areas. With an estimated by-product recovery of 10 thousand board feet (MBF) of timber per harvest acre, approximately 32-42 million board feet (MMBF) of timber could be recovered over 6 to 8 years through multiple timber sales - if all sales were successfully sold.
3. **Alternative 3** proposes salvage harvest of dead and dying spruce trees across the same 6,530 treatment acres as Alternative 2 without constructing or reconstructing roads in inventoried roadless areas (RARE II and Forest Plan) or using ground-based log yarding equipment in such areas. This alternative does include road maintenance (0.8 miles) in a Forest Plan inventoried roadless area (Heliotrope). It also includes approximately 15 miles of Forest Development Road reconstruction and 8 miles of temporary road construction followed by reclamation. This alternative includes the same Forest Development Road, nonsystem road, and motorized trail reclamation as Alternative 2. Past experience indicates that 50 to 65 percent of the treatment area is likely to be harvested (3,200 to 4,200 acres). With an estimated by-product recovery of 10 MBF of timber per harvest acre, approximately 32 to 42 MMBF of timber could be recovered over 6 to 8 years through multiple timber sales - if all sales were successfully sold. This alternative would cost substantially more than Alternative 2.
4. **Alternative 4** proposes salvage harvest of dead and dying spruce trees across 3,974 treatment acres without harvesting in or developing roads in inventoried roadless areas (RARE II and Forest Plan). This alternative includes the same Forest Development Road, nonsystem road, and motorized trail reclamation as Alternative 2. Past experience indicates that 50 to 65 percent of the treatment area is likely to be harvested (2,000 to 2,600 acres). With an estimated by-product recovery of 10 MBF of timber per harvest acre, approximately 20 to 26 MMBF of timber could be recovered over 5 to 7 years through multiple timber sales - if all sales were successfully sold.

The Agency's final interim rule of March 1, 1999, affects the alternatives considered in detail as summarized below. The effects of the Agency's final interim rule upon the alternatives considered in detail are further presented in Chapter 2 of the Draft Environmental Impact Statement (detailed descriptions are on pages 2-14 through 2-16, maps are on pages 2-29 through 2-33).

1. **Alternative 1** would not be affected by the Agency's final interim rule of March 1, 1999.
2. **Alternative 2** would be affected by the Agency's final interim rule of March 1, 1999. Of the 6,530 acres identified for treatment, 482 acres could not be reasonably treated. Approximately 372 acres of identified ground-based yarding would have to be treated using helicopter yarding to accomplish the project's purpose and need. Approximately 76 acres of identified optional cable yarding would have to be treated using helicopter yarding to accomplish the project's purpose and need. Approximately 4 miles of Forest Development Road reconstruction and 8 miles of temporary road construction followed by reclamation would not occur. Landing areas affected by these changes would be relocated or dropped. The identified road construction within the Forest Plan inventoried roadless area (Heliotrope) would still be permissible as it is within a roaded corridor. These changes in treatment would result in a reduced estimated by-product recovery of 30 to 39 MMBF, instead of 32 to 42 MMBF.
3. **Alternative 3** would be affected by the Agency's final interim rule of March 1, 1999. Of the 6,530 acres identified for treatment, 482 acres could not be reasonably treated. Approximately 301 acres of identified ground-based yarding would have to be treated using helicopter yarding to accomplish the project's purpose and need. Approximately 76 acres of identified optional cable yarding would have to be treated using helicopter yarding to accomplish the project's purpose and need. Approximately 4 miles of Forest Development Road reconstruction and 8 miles of temporary road construction followed by reclamation would not occur. Landing areas affected by these changes would be relocated or dropped. These changes in treatment would result in a reduced estimated by-product recovery of 30 to 39 MMBF, instead of 32 to 42 MMBF.
4. **Alternative 4** would be affected by the Agency's final interim rule of March 1, 1999. Of the 3,974 acres identified for treatment, 430 acres could not be reasonably treated. Approximately 301 acres of identified ground-based yarding would have to be treated through helicopter yarding to accomplish the project's purpose and need. Approximately 76 acres of identified optional cable yarding would have to be treated through helicopter yarding to accomplish the project's purpose and need. Approximately 1 miles of Forest Development Road reconstruction and 8 miles of temporary road construction followed by reclamation would not occur. Landing areas affected by these changes would be relocated or dropped. These changes in treatment would result in a reduced estimated by-product recovery of 18 to 23 MMBF, instead of 20 to 26 MMBF.

None of the alternatives are currently identified as the "preferred" alternative. Each alternative represents a different scenario for management with correspondingly different effects. Your alternative-specific comments will help in making the final decision. The final decision will reflect Agency policy in effect at the time of decision.

Reviewers should provide the Forest Service with their comments during the review period of the Draft Environmental Impact Statement. This will enable the Forest Service to analyze and respond to the comments at one time and use information acquired in the preparation of the Final Environmental Impact Statement, thus avoiding undue delay in the decisionmaking process. Reviewers have an obligation to structure their participation in the National Environmental Policy Act process so that it is meaningful and alerts the agency to the reviewers' positions and contentions. Vermont Yankee Nuclear Power Corp. v. NRDC, 435 U.S. 519, 533 (1978). Environmental objections that could have been raised at the draft stage may be waived if not raised until after completion of the Final Environmental Impact Statement. City of Angoon v. Hodel (9th Circuit, 1986) and Wisconsin Heritages, Inc. v. Harris, 490 F. Supp. 1334 (E.D. Wis., 1980). Comments on the Draft Environmental Impact Statement should be specific and should address the adequacy of the statement and merits of the alternatives discussed (40 CFR 1503.3).

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Comments on this Draft Environmental Impact Statement must be received or postmarked at the Responsible Official's address by June 28, 1999.

Those who do not respond to this solicitation of comments, or otherwise provide notice of their continued interest, will not receive the resulting Final Environmental Impact Statement or Record of Decision.

SUMMARY

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EXECUTIVE SUMMARY

Introduction

This project was initiated in response to epidemic spruce beetle (*Dendroctonus rufipennis*) activity across the South Manti landscape. This Environmental Impact Statement summarizes potential direct, indirect, and cumulative effects of corresponding site-specific forest management alternatives on portions of the Ferron-Price and Sanpete Ranger Districts of the Manti-La Sal National Forest.

Overview of the Area

The project area includes approximately 24,597 acres of National Forest System lands within the southern portion of the Wasatch Plateau on the Ferron-Price and Sanpete Ranger Districts of the Manti-La Sal National Forest, in Sanpete and Sevier Counties, Utah (Townships 19, 20, and 21 South; Range 4 East; SLM). The project area is approximately 10 miles southwest of the town of Manti, 12 miles east of the town of Mayfield, 19 miles west of the town of Ferron, and 45 miles southwest of the town of Price. The project area extends from White Mountain, along the Manti-La Sal and Fishlake National Forest boundaries, north to the headwaters of Ferron and Sixmile drainages. (See Figure S-1 Vicinity Map, at the end of this Executive Summary)

The project area is characterized by a mountainous terrain which includes rock formations and glacial cirques. There are panoramic ridges and valley views (some containing lakes or reservoirs) of subalpine scenery. There is evidence of past and present management in the area such as grazing, timber harvest, roads, trails, and camping areas which has shaped the overall landscape conditions. Dispersed recreation is evident by camping areas and road and trail use.

Vegetation in the project area is represented predominantly by three cover types: Engelmann spruce-Subalpine fir (47%), grass and brush (36%), and aspen (12%). The Engelmann spruce-Subalpine fir cover type represents over 10,000 acres in the project area. A spruce beetle epidemic has affected most of the spruce within this area. As a result, most spruce trees are dead or dying. Dead trees are those spruce trees in which the flow of nutrients in the cambium/phloem layer, beneath the bark, has ceased. These trees may or may not look dead, depending upon how long they have been dead. Dying trees are those spruce trees with multiple spruce beetle attacks that encircle the tree bole. Dying trees are usually dead within a year of such infestation. Seventy percent of the spruce trees with a diameter greater than five inches at breast height and ninety percent of the spruce trees with a diameter greater than eleven inches at breast height are dead.

Public Involvement

A "Notice of Intent to Prepare an Environmental Impact Statement" was printed in the Federal Register, which is distributed nationally, on February 17, 1998. The Notice of Intent described the proposal and requested public comment. Local comments on the proposal were requested by newspaper notices in Carbon, Emery, and Sanpete Counties, Utah. Additional comments were sought by notice in the Forest's Schedule of Proposed Actions and by mailing of individual letters. On October 5, 1998, a field trip was held to explain the proposed action to interested publics and gain their input.

Purpose and Need

Management of the project area is part of the Manti-La Sal National Forest's attempt to fulfill the Forest Service commitment of "caring for the land and serving people". Nationally, the Forest Service has identified a Natural Resource Agenda to reemphasize its commitment of "caring for the land and serving people". The Agenda focuses on four key emphasis areas: watershed health and restoration, sustainable forest ecosystem management, improved management of the National Forest road system, and improved recreation opportunities and experiences. This project embraces the Agenda's goals.

The purpose and need for this project is to address ecological and economic values affected by spruce beetle activity in the South Manti project area as defined below.

1. Reduce potential for large and intense wildfires across forested areas (with associated environmental affects).
2. Facilitate rapid reestablishment of Engelmann spruce through replanting of spruce in Timber Emphasis Units identified in the Forest Plan.
3. Recover some of the economic value of dead and dying trees.

Issues

Issues are derived from review of the proposed action that was developed in response to the identified purpose and need for the project. Issues are the basis for the project analysis, project design features, alternatives, and disclosure of information. There are fifteen issues associated with this project. One issue relative to the proposed action is considered a significant issue in that it was a basis from which to develop alternatives - Issue #15, Impacts to Roadless Character.

The issues associated with this project are summarized below.

Issue #1 - Impacts to Air Quality: Timber harvest and associated activities could have short-term effects on air quality.

Issue #2 - Impacts to Land Stability: Road construction and reconstruction could reduce land stability and induce landslides which could damage resources. Reforestation could improve land stability.

Issue #3 - Impacts to Soil Erosion and Productivity: Timber harvest and associated activities could compact or displace soil. Compacted and displaced soil could be subject to erosion and loss of productivity. Road construction and reconstruction could displace soil and temporarily remove the land from resource production.

Issue #4 - Impacts to Water Resources: Timber harvest, associated activities, and road work could impact the quantity and quality of water resources, including aquatic systems, habitat, and species.

Issue #5 - Impacts to Vegetation Resources: The spruce beetle epidemic has altered the vegetative condition of the landscape. The majority of spruce trees are dead or dying from spruce beetle activity. Timber harvest could remove dead and dying spruce trees. Reforestation could facilitate reestablishment of spruce. Soil disturbed by timber harvest and road work could provide an opportunity for weed seed to germinate. Timber harvest, associated activities, and road work could affect sensitive plants or their habitat.

Issue #6 - Impacts to Fuel Loading and Fire Risk: The majority of spruce trees are dead or dying from spruce beetle activity. These dead trees have increased the amount of fuel, and corresponding wildfire risks, across the landscape. Timber harvest could remove dead and dying spruce trees, thereby reducing the amount of fuel and associated wildfire potential.

- Issue #7 - Impacts to Wildlife Resources:** Timber harvesting and road work could alter the habitat, behavior, and risk of mortality of management indicator species, tree cavity dependant species, proposed species, threatened species, endangered species, and sensitive species.
- Issue #8 - Impacts to Transportation System:** Road work affects the transportation system and access opportunities across the landscape. Road work and hauling timber on publicly used roads could impact Forest users in terms of safety and travel delays.
- Issue #9 - Impacts to Range Allotments and Improvements:** Timber harvest, associated activities, and road work could affect the operation of range allotments and existing range improvements, such as springs and fences.
- Issue #10 - Impacts to Visual Landscape:** The spruce trees, averaging about 70 percent of the mixed-conifer forest visual landscape, have been infested by beetles. These beetles have killed the majority of the spruce trees. As the spruce trees die, their appearance changes. Timber harvest would remove some of these dead trees. Timber harvest and road work could further alter the visual landscape and affect visitors' experiences.
- Issue #11 - Impacts to Undeveloped Character:** Timber harvest, associated activities, and road work could impact the undeveloped character of the landscape.
- Issue #12 - Impacts to Cultural Resources:** Timber harvest and associated activities could affect cultural resources.
- Issue #13 - Impacts to Economics:** Timber harvest and associated activities may affect the economies of local communities and contribute to the National treasury.
- Issue #14 - Impacts to Energy:** Timber harvesting and associated activities consume fuel.
- Issue #15 - Impacts to Roadless Character:** Timber harvest, associated activities, and road work could impact inventoried roadless areas (RARE II and Forest Plan) and their roadless characteristics.

**Alternatives Considered
But Not Given
Detailed Study**

Several conceptual alternatives were explored in refining the alternatives to be considered in detail. Alternatives considered but not carried into the final analysis are summarized in the following.

- Harvesting of spruce trees beyond those presented in the proposed action were not given detailed study because field review raised logging feasibility and economic concerns, as well as additional resource concerns.
- Road construction, permanent and temporary, in RARE II inventoried roadless areas was not given detailed study because of current social values and the ability to meet the project's purpose and need without such additional roading. Correspondingly, extensive ground-based yarding in RARE II inventoried roadless areas was not given detailed study because of limited access.
- Yarding and hauling of harvested timber from the southern end of the project area (D treatment areas) primarily through Millfork/Blackfork drainages (Forest Development Roads #50333 and #50044) was not given detailed study because analysis showed costs would not be feasible in comparison to yarding and hauling, in combination, across the top of Baseball Flat (Forest Development Road #50161) and through the Millfork/Blackfork drainage.
- Under current conditions, prescribed fire without prior treatment such as timber harvest to reduce the fuel loading was not given detailed study for several reasons (e.g. fire behavior of burning areas with heavy concentrations of dead trees is unpredictable, the ability to control and extinguish a fire would be unlikely, and unacceptable effects would be expected such as killing live trees, removing an important seed source for reforestation, and reducing big-game security habitat). Additionally, prescribed fire has a limited window of opportunity under which a fire could be managed to meet desired conditions.
- Aspen stand management was not given detailed study because it is not responsive to the project's purpose and need. Additionally, impacts of aspen removal, to stimulate new sprouts, would be undesirable at this time because it would further reduce hiding cover and security habitat for deer and elk. Aspen planting was also not given detailed study because its success is limited by site characteristics not prevalent in the treatment areas. However, the proposed action and action alternatives account for the presence of aspen in the harvest areas.
- An alternative using cable yarding systems on slopes greater than 40 percent instead of helicopter was considered. Although some areas are topographically suitable for cable yarding and cable yarding is more cost efficient than helicopter yarding, it was not given area-wide detailed study because of potential adverse effects - including environmental and economical consequences of building roads on steep, unstable slopes. However, helicopter yarding areas with adequate existing access for cable yarding are identified and included in the action alternatives with an option for cable yarding.
- Reclassification of suitable timberland was not given detailed study because it is beyond the project's scope and would not affect achievement of the purpose and need or respond to an identified issue.
- Based upon additional field review and public comment, the original proposal of February 17, 1998, has been modified as presented in Alternative 2. Therefore, the original proposal has been dropped from further consideration.

Alternatives Considered in Detail

A no action alternative and three action alternatives were considered in detail. These alternatives represent a reasonable range of alternatives for this project that sharply define the significant issue. The alternatives considered in detail are summarized below and mapped in Figures S-2 through S-5 at the end of this Executive Summary. Key components of the alternatives are summarized in Figure S-6 Alternative Summary without Final Interim Rule.

Alternative 1 - Alternative 1, the no action alternative, proposes no new activities to be initiated in the project area from this planning effort at this time. (See Figure S-2 Alternative 1, at the end of this Executive Summary)

Alternative 2 - Based upon additional field review and public comment, Alternative 2 is a modification of the original proposal (February 17, 1998). Alternative 2 represents the intent of the original proposal. Alternative 2 proposes salvage harvest of dead and dying spruce trees across 6,530 treatment acres outside and within inventoried roadless areas (RARE II and Forest Plan). Approximately 3,988 treatment acres are outside of inventoried roadless areas, 1,070 treatment acres are within RARE II inventoried roadless areas, and 1,472 treatment acres are within a Forest Plan inventoried roadless area (Heliotrope). Past experience indicates that 50 to 65 percent of the treatment area is likely to be harvested (3,200 to 4,200 acres). This alternative does not include road construction or reconstruction in RARE II inventoried roadless areas. This alternative does include road construction (1.1 miles) and road maintenance (0.8 miles) in a Forest Plan inventoried roadless area (Heliotrope). This alternative also includes approximately 15 miles of Forest Development Road reconstruction and 8 miles of temporary road construction followed by reclamation. Forest Development Road, nonsystem road, and nonsystem motorized trail reclamation within (4) miles and outside (18) miles of inventoried roadless areas is also included in this alternative. With an estimated by-product recovery of 10 thousand board feet (MBF) of timber per harvest acre, approximately 32 to 42 million board feet (MMBF) of timber could be recovered over 6 to 8 years through multiple timber sales - if all sales were successfully sold. (See Figure S-3 Alternative 2, at the end of this Executive Summary)

Alternative 3 - Alternative 3 proposes salvage harvest of dead and dying spruce trees across the same 6,530 treatment acres as Alternative 2 without constructing or reconstructing roads in inventoried roadless areas (RARE II and Forest Plan) or using ground-based log yarding equipment in such areas. This alternative does include road maintenance (0.8 miles) in a Forest Plan inventoried roadless area (Heliotrope). It also includes the same Forest Development Road reconstruction, temporary road construction followed by reclamation, and motorized access reclamation as Alternative 2. Past experience indicates that 50 to 65 percent of the treatment area is likely to be harvested (3,200 to 4,200 acres). With an estimated by-product recovery of 10 MBF of timber per harvest acre, approximately 32 to 42 MMBF of timber could be recovered over 6 to 8 years through multiple timber sales - if all sales were successfully sold. This alternative would cost substantially more to implement than Alternative 2. (See Figure S-4 Alternative 3, at the end of this Executive Summary)

Alternative 4 - Alternative 4 proposes salvage harvest of dead and dying spruce trees across 3,974 treatment acres without harvesting in or developing roads in inventoried roadless areas (RARE II and Forest Plan). This alternative includes the same Forest Development Road reconstruction, temporary road construction followed by reclamation, and motorized access reclamation as Alternative 2. Past experience indicates that 50 to 65 percent of the treatment area is likely to be harvested (2,000 to 2,600 acres). With an estimated by-product recovery of 10 MBF of timber per harvest acre, approximately 20 to 26 MMBF of timber could be recovered over 5 to 7 years through multiple timber sales - if all sales were successfully sold. (See Figure S-5 Alternative 4, at the end of this Executive Summary)

Figure S-6 Alternative Summary without Final Interim Rule¹

Description	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Treatment Area (acres)	0	6,530	6,530	3,974
Log Yarding Method across Treatment Area:				
Ground-Based (acres)	0	1,617	1,067	1,067
Cable/Helicopter (acres)	0	115	115	115
Helicopter (acres)	0	4,798	5,348	2,792
Treatment Area Harvested² (acres)	0	3,200 to 4,200	3,200 to 4,200	2,000 to 2,600
Treatment Area Harvested by Log Yarding Method:				
Ground-Based (acres)	0	809 to 1,051	534 to 694	534 to 694
Cable/Helicopter (acres)	0	58 to 75	58 to 75	58 to 75
Helicopter (acres)	0	2,399 to 3,119	2,674 to 3,476	1,396 to 1,815
By-Product Recovery³ by Yarding Method:				
Timber Recovered by Ground-Based Yarding (MMBF)	0	7.9 to 10.5	5.4 to 6.9	5.4 to 6.9
Timber Recovered by Cable/Helicopter Yarding (MMBF)	0	0.6 to 0.7	0.6 to 0.7	0.6 to 0.7
Timber Recovered by Helicopter Yarding (MMBF)	0	23.5 to 31.2	26.0 to 34.8	14.0 to 18.1
Roads:				
FDR ⁴ Construction (miles)	0	1	0	0
FDR Reconstruction (miles)	0	15	15	15
Temporary Construction followed by Reclamation (miles)	0	8	8	8
FDR Construction to Level 1 Maintenance after use ⁵ (miles)	0	1	0	0
FDR Reclamation (miles)	0	4	4	4
Nonsystem Road and Motorized Trail Reclamation (miles)	0	18	18	18
Post-project Road and Motorized Trails ⁶ (miles)	93	70	70	70
Post-project Road and Motorized Trail Density ⁶ (miles/miles ²)	2.4	1.8	1.8	1.8
Reforestation:				
Artificial Reforestation - Planting (acres)	0	1,133	1,133	696
Natural Reforestation (acres)	0	1,888	1,888	1,160
Natural Reforestation Site Preparation (acres)	0	877	877	539
Reforestation Protection - Gopher Control (acres)	0	1,246	1,246	766

1. Key components expected over 5 to 8 years if an alternative is fully implemented.
2. Minor differences may exist between associated components due to rounding of values during calculations.
3. Approximately 50 to 65 percent of the treatment area is likely to be harvested.
4. Based on estimated timber by-product recovery of 10 MBF per harvest acre.
5. FDR is the abbreviation for "Forest Development Road", also referred to as a system road.
6. This conversion to level 1 maintenance after use by the project is referring to the same FDR road segment as that proposed for construction.
6. Includes FDR, nonsystem roads, and nonsystem motorized trails.

On March 1, 1999, the Agency released a final interim rule which temporarily suspends decisionmaking on road construction and reconstruction in many unroaded areas within the National Forest System until a revised policy is issued or 18 months from the effective rule date, whichever is sooner. The interim rule would affect the action alternatives considered in detail: less acreage could reasonably be treated (430 to 482 acres less); more treatment would have to be accomplished using helicopter logging (375 to 448 acres more); less road in need of repair would be reconstructed (4 miles less); less temporary road construction followed by reclamation would occur (8 miles less); and less timber by-products would be recovered (2 to 3 MMBF less). Brief descriptions of these changes by alternative are presented below. Summary details of the changes are presented in Figure S-7 Alternative Results from Final Interim Rule, Figure S-8 Unit Changes from Final Interim Rule, and Figure S-9 Roding Changes from Final Interim Rule. The resulting alternative changes from the final interim rule are mapped in Figures S-10 through S-12, at the end of this Executive Summary.

Final Interim Rule Impact to Alternative 2

Alternative 2 would be affected by the Agency's final interim rule of March 1, 1999. Of the 6,530 acres identified for treatment, 482 acres could not be reasonably treated. Approximately 372 acres of identified ground-based yarding would have to be treated using helicopter yarding to accomplish the project's purpose and need. Approximately 76 acres of identified optional cable yarding would have to be treated using helicopter yarding to accomplish the project's purpose and need. Approximately 4 miles of Forest Development Road reconstruction and 8 miles of temporary road construction followed by reclamation would not occur. Landing areas affected by these changes would be relocated or dropped. The identified road construction within the Forest Plan inventoried roadless area (Heliotrope) would still be permissible as it is within a roaded corridor. These changes in treatment would result in a reduced estimated by-product recovery of 30 to 39 MMBF, instead of 32 to 42 MMBF.

Final Interim Rule Impact to Alternative 3

Alternative 3 would be affected by the Agency's final interim rule of March 1, 1999. Of the 6,530 acres identified for treatment, 482 acres could not be reasonably treated. Approximately 301 acres of identified ground-based yarding would have to be treated using helicopter yarding to accomplish the project's purpose and need. Approximately 76 acres of identified optional cable yarding would have to be treated using helicopter yarding to accomplish the project's purpose and need. Approximately 4 miles of Forest Development Road reconstruction and 8 miles of temporary road construction followed by reclamation would not occur. Landing areas affected by these changes would be relocated or dropped. These changes in treatment would result in a reduced estimated by-product recovery of 30 to 39 MMBF, instead of 32 to 42 MMBF.

Final Interim Rule Impact to Alternative 4

Alternative 4 would be affected by the Agency's final interim rule of March 1, 1999. Of the 3,974 acres identified for treatment, 430 acres could not be reasonably treated. Approximately 301 acres of identified ground-based yarding would have to be treated through helicopter yarding to accomplish the project's purpose and need. Approximately 76 acres of identified optional cable yarding would have to be treated through helicopter yarding to accomplish the project's purpose and need. Approximately 4 miles of Forest Development Road reconstruction and 8 miles of temporary road construction followed by reclamation would not occur. Landing areas affected by these changes would be relocated or dropped. These changes in treatment would result in a reduced estimated by-product recovery of 18 to 23 MMBF, instead of 20 to 26 MMBF.

Figure S-7 Alternative Results from Final Interim Rule ¹.

Description	Alternative 2	Alternative 3	Alternative 4
Treatment Area (acres)	6,048	6,048	3,599
Log Yarding Method across Treatment Area:			
Ground-Based (acres)	847	433	433
Cable/Helicopter (acres)	39	39	39
Helicopter (acres)	5,162	5,576	3,127
Treatment Area Harvested² (acres)	3,024 to 3,391	3,024 to 3,391	1,800 to 2,339
Treatment Area Harvested by Log Yarding Method:			
Ground-Based (acres)	424 to 551	217 to 281	217 to 281
Cable/Helicopter (acres)	20 to 25	20 to 25	20 to 25
Helicopter (acres)	2,581 to 3,355	2,788 to 3,624	1,564 to 2,075
By-Product Recovery³ by Yarding Method:			
Timber Recovered by Ground-Based Yarding (MMBF)	4.2 to 5.5	2.2 to 2.8	2.2 to 2.8
Timber Recovered by Cable/Helicopter Yarding (MMBF)	0.2 to 0.3	0.2 to 0.3	0.2 to 0.3
Timber Recovered by Helicopter Yarding (MMBF)	25.8 to 33.6	27.9 to 36.2	15.6 to 20.7
Roads:			
FDR ⁴ Reconstruction (miles)	11	11	11
Temporary Construction followed by Reclamation (miles)	0	0	0

1. Key components expected over 5 to 8 years if an alternative is fully implemented.
2. Minor differences may exist between associated components due to rounding of values during calculations.
3. Approximately 50 to 65 percent of the treatment area is likely to be harvested.
4. Based on estimated timber by-product recovery of 10 MBF per harvest acre.
5. FDR is the abbreviation for "Forest Development Road", also referred to as a system road.

Figure S-8 Unit Changes from Final Interim Rule ¹.

TREATMENT UNIT	TREATMENT AREA DROPPED	
	ground-based	helicopter
F-1, All Alternatives	41 acres (central and west)	
D-1, All Alternatives	93 acres (all at north)	
D-2, All Alternatives	30 acres (all)	
D-3, All Alternatives		
D-4/5, Alternative 2	134 acres (all at south)	84 acres (partial at south)
D-4/5, Alternative 3	69 acres (all at south)	149 acres (partial at south)
D-4/5, Alternative 4	69 acres (all at south)	42 acres (partial at south)

TREATMENT UNIT	TREATMENT CHANGE TO HELICOPTER	
	ground-based	cable/helicopter
F-1, All Alternatives		76 acres (all)
D-1, All Alternatives	81 acres (all at south)	
D-2, All Alternatives		
D-3, All Alternatives	131 acres (all at south)	
D-4/5, Alternative 2	160 acres (all at north)	
D-4/5, Alternative 3	89 acres (all at north)	

1. At the end of this Executive Summary, refer to Figures S-3 through S-5 for treatment unit mapping without the final interim rule, and Figures S-10 through S-12 for treatment unit mapping with the final interim rule.

Figure S-9 Roding Changes from Final Interim Rule ¹.

AREA/TREATMENT UNIT	ROAD WORK DROPPED
All Alternatives	4 miles reconstruction off of FDR ² . #50161
F-1, All Alternatives	0.3 miles temporary road construction followed by reclamation off of FDR #52062
D-1, All Alternatives	1.5 miles temporary road construction followed by reclamation off of FDR #50161 and #50169
D-2 & 3, All Alternatives	0.8 miles temporary road construction followed by reclamation off of FDR #50333
D-3 & 4, All Alternatives	3.3 miles temporary road construction followed by reclamation off of FDR #50161
D-4/5, All Alternatives	1.9 miles temporary road construction followed by reclamation off of FDR #50333

1. At the end of this Executive Summary, refer to Figures S-3 through S-5 for road work mapping without the final interim rule, and Figures S-10 through S-12 for road work mapping with the final interim rule.
2. FDR is the abbreviation for "Forest Development Road", also referred to as a system road.

Decisions To Be Made

The Responsible Official, Forest Supervisor of the Manti-La Sal National Forest, will make the following decisions associated with this document:

- Whether to harvest dead and dying trees, and if so, the location, methods of harvest, silvicultural diagnosis, reforestation, and post-sale activities;
- Whether to change short-term and/or long-term access, and if so, the location, methods of road construction, reconstruction, maintenance, rehabilitation, closure, and access management;
- What, if any, additional measures are necessary to implement a decision;
- What, if any, specific project monitoring requirements are needed to assure selected measures are implemented and effective; and,
- Whether Forest Plan Amendments are needed to implement a decision.

Conclusion of Effects

The disclosure of information is intended to provide a meaningful basis for public review and comment. The effects of each alternative considered in detail can be meaningfully summarized by how well they respond to the identified purpose and need and issues.

Purpose and Need

Figure S-13 Comparison of Alternatives by Purpose and Need without Final Interim Rule, summarizes how well each alternative would address the identified purpose and need.

The reduced treatment acreages associated with the final interim rule would reduce the project's responsiveness to the purpose and need: less area would be treated to reduce the potential for large/intense wildfire, less area would have rapid reestablishment of spruce; and less timber by-products would be recovered. Additionally, the final interim rule would require more treatment to be accomplished using helicopter logging instead of ground-based or cable. The resulting project would consist of 85 percent to 92 percent helicopter yarding. This change to helicopter yarding would increase the project's costs and reduce its marketability.

Figure S-13 Comparison of Alternatives by Purpose and Need without Final Interim Rule

Purpose and Need	Alternative 1	Alternative 2	Alternative 3	Alternative 4
#1 Reduced Potential for Large/Intense Wildfires - Acres Treated to Reduce the Amount of Fuel - Wildfire Potential Risk Rating	0 high	6,530 low	6,530 low-mod	3,974 mod
#2 Rapid Spruce Reestablishment by Planting in Timber Mgmt. Emphasis Units (TBR) - Years to Full Stocking ¹ of Spruce <u>without Planting</u> - Years to Full Stocking ¹ of Spruce <u>with Planting</u> - Acres Planted ² in TBR Areas Treated - Years to Pre-epidemic Conditions <u>without Planting</u> - Years to Pre-epidemic Conditions <u>with Planting</u>	30 to 90 N/A 0 100 to 200 N/A	30 to 90 5 400 100 to 200 30 to 40	30 to 90 5 400 100 to 200 30 to 40	30 to 90 5 240 100 to 200 30 to 40
#3 Economic Recovery of Dead and Dying Trees - Timber By-Product Recovered (MMBF) - Expected Revenue from Timber By-Product - Twenty-five Percent Sale Revenues to Counties - Years to Commercial Age ³ <u>without Planting</u> - Years to Commercial Age ³ <u>with Planting</u>	0 0 0 80 to 140 N/A	32 to 42 \$320,000 \$80,000 80 to 140 70 to 100	32 to 42 \$320,000 \$80,000 80 to 140 70 to 100	20 to 26 \$200,000 \$50,000 80 to 140 70 to 100

1. Full stocking exists when there are 3 to 5 trees per acre.
2. Planting needs were identified through inventory data and modelling.
3. To be considered commercial, the average stand diameter would have to be at least 8 to 10 inches at breast height.

Issues

The following narratives provide a brief presentation of potential effects from implementing the alternatives considered in detail as indicated by issue comparison elements. Unless otherwise noted, potential changes associated with the final interim rule would result in slightly less environmental effects, proportional to the acreage treated and amount of road work, than those disclosed in the following issue comparison.

Air Quality

All alternatives would comply with State air quality requirements.

Land Stability

Mortality of spruce trees in the project area is causing a decrease in land stability and an increase in the potential for landslides. The removal of dead and dying trees would not, in itself, affect land stability. Road construction, road reconstruction, and staging areas in unstable and moderately unstable areas could induce local landslides. However, such facilities would be designed to minimize landslide risk. Notable differences in effects to land stability are not expected between the action alternatives. Accelerated reforestation by planting of spruce would improve land stability with time.

Soils

All action alternatives would disturb soil. Ground-based yarding would result in exposed soil over 15 to 20 percent of the harvested area. Cable yarding and helicopter yarding would result in exposed soil over 3 to 4 percent of the harvested area. It is estimated that soil erosion would range from 0.1 to 2 tons per acre per year over the ground-based logged areas, and would decrease over time as vegetation becomes established. Soil

erosion from cable yarding and helicopter yarding would be considerably less than that of ground-based yarding. Although there are some differences between the action alternatives, notable differences in effects to the soil resources are not expected.

Road reconstruction, maintenance, and reclamation in the action alternatives would improve soil conditions and reduce erosion concerns.

Water Resources

Water yield in the area has and will increase as a result of beetle-induced spruce tree mortality. Water yield increases are predicted to range from 1 to 3 percent of mean annual flow at the farthest downstream portion of the watershed (point of cumulative effects) in Muddy Creek, Ferron Creek, Twelvemile Creek, and Sixmile Creek. Some stream reaches of subwatersheds will have greater water yield increases. Seven subwatersheds will likely have severe channel alternations from increased water yields of 10 percent or more: Greens hollow, Mill Fork, Black Fork, Emerald, and North Fork of the Muddy Creek drainage and Duck Fork and Little Horse of the Ferron Creek drainage. The action alternatives would have similar water yield increases and associated effects as the no action alternative because dead trees do not use groundwater or transpire it into the atmosphere. Another reason there is similarity between alternatives is because the action alternatives would only remove incidental live trees associated with logging, landings, and road work across the landscape (40 to 50 acres). Hydrologic recovery, the return of streamflow to pre-epidemic conditions, will take about 30 years. Until hydrologic recovery occurs, riparian and wetland areas may be slightly enlarged from the increased water yield.

Changes to sediment loads in the streams would be small and not measurable. Due to large natural variations in sediment loads, the small anticipated changes in sediment would not adversely affect the beneficial uses of water. Temporary increases in sedimentation from ground disturbance associated with logging activities would be short term (1 to 3 years). Temporary increases in sedimentation would be expected from road reconstruction (Alternative 2 only), maintenance, and reclamation included in the action alternatives. Over the long-term, road reconstruction, maintenance, and reclamation associated with the action alternatives would result in reductions of potential sediment transport. The application of best management practices would reduce potential impacts to soil and water resources.

No trees are to be removed from Riparian Units except at road crossings. Alternative 2 has 18 road crossings of perennial streams (8 crossings are for road construction, 10 crossings are for road reconstruction). Alternatives 3 and 4 have 14 road crossings of perennial streams (6 crossings are for road construction, 8 crossings are for road reconstruction). The limited removal of trees and logs in Riparian Units should insignificantly affect the hydrologic function of the area.

There are no known threatened, endangered, proposed, or sensitive fish or amphibian species within the project area. There would be no effect to any fish or amphibian listed species from implementation of the alternatives.

Vegetation Resources

Epidemic spruce beetle activity has killed the majority of the spruce trees in the area. This has reduced stand development, growth, and production levels in affected areas. Without treatment, it would take 30 to 90 years for adequate natural reforestation of affected spruce stands. With treatment, reforestation would be assured in less time (5 years). Without treatment, it could take 100 to 200 years to return affected spruce stands to pre-epidemic stocking levels. With treatment, return to pre-epidemic stocking and production levels would be expected in less time (60 to 70 years sooner than untreated areas). Additionally, the post-genetic gene pool would be supplemented by planting spruce trees.

Rangeland vegetative trends and production would increase with or without treatment. The rate of improvement would be greater with treatment than without. Weeds would occur with or without treatment. The risk and rate of weed expansion is greater with treatment because of ground disturbance and increased activity in the area. However, weed populations would be treated in accordance with existing decisions and agreements.

No endangered plant species exist within the project area. One threatened plant species exists within the project area (Heliotrope milkvetch). There would be "no effect" to Heliotrope milkvetch from implementation of any of the alternatives.

Four sensitive plant species occur within the project area (Carrington daisies, Arizona willow, Musinea groundsel, Maguire campion). There would be "no impact" to Carrington daisies or Arizona willow from implementation of any of the alternatives. Use of the South Camel gravel source for road work and maintenance "may impact" individual Maguire campion and Musinea groundsel and/or their habitat but will not likely contribute to trend toward Federal listing or loss of viability to the population or species. This "may impact" determination for Maguire campion or Musinea groundsel is only applicable to use of the gravel at the South Camel gravel source. Other project activities would have a "no effect" determination for these species.

Fuels

The abundance of dead spruce trees increases wildfire concerns, should a fire start under favorable conditions. A large, intense wildfire could have considerable adverse effects. Current fuel loadings in the spruce stands average 30 tons per acre (3 times pre-epidemic levels). Without treatment, fuel loadings are expected to exceed 70 tons per acre (7 times pre-epidemic levels). Within treated areas, fuel loadings would be reduced to 10 to 15 tons per acre. Alternatives 2 and 3 treat more acreage than Alternative 4. The wildfire potential rating differs between alternatives: Alternative 1 has a high rating, Alternative 2 has a low rating, Alternative 3 has a moderate-low rating, Alternative 4 has a moderate rating.

Wildlife Resources

Wildlife habitat would be affected by the alternatives. However, no alternative would contribute to a loss of population viability.

Management Indicator Species

Elk and Deer: With no action, Alternative 1, hiding cover in the affected spruce stands would be reduced as dead spruce trees die and fall to the ground. Also with no action, existing access and associated impacts would continue (90 miles of roads and motorized trails). During implementation of any action alternative, the hiding and security cover for elk and deer would temporarily be reduced proportional to the acreage treated and amount of road work. However, after implementation of the action alternatives, reforestation would provide hiding cover in 15 to 20 years and habitat effectiveness would be increased by the reclamation of 22 miles of Forest Development Roads, nonsystem roads, and nonsystem motorized trails.

Blue Grouse: With no action, Alternative 1, effects to blue grouse habitat would come from natural succession. Impacts from the action alternatives would primarily come from harvest-related activities and road work that inadvertently removes or damages aspen or fir trees.

Golden Eagle: Since the beetle epidemic has already changed the character of the spruce stands to one of a more open habitat, none of the alternatives would notably impact foraging habitat for eagles.

Tree Cavity Dependent Species

All alternatives would continue to provide an abundance of tree cavity habitat in excess of individual tree cavity dependant species' needs. Within treatment areas, the retention of non-spruce trees and 300 snags per 100 acres would provide for snag maintenance and snag recruitment over time.

Proposed, Threatened, and Endangered Species

Canada Lynx (Proposed Threatened): There would be "no effect" to Canada lynx from Alternative 1. The action alternatives "may affect individuals or habitat, but will not likely contribute to a trend towards Federal listing or loss of viability to the population or species". Adverse habitat impacts from the action alternatives would be as a result of increased human activities in winter habitat. However, there has not been a sighting of lynx in this area since the 1950's. Beneficial habitat impacts from the action alternatives would occur from reforestation.

Bald Eagle (Threatened): There would be "no effect" to bald eagles from Alternative 1. The action alternatives "may affect individuals or habitat, but will not likely contribute to a trend towards Federal listing or loss of viability to the population or species". Impacts from the action alternatives include possible disturbance from helicopter activity during eagle migration through the area.

Peregrine Falcon (Endangered): There would be "no effect" to peregrine falcon from implementation of any of the alternatives.

Southwest Willow Flycatcher (Endangered): There would be "no effect" to Southwest willow flycatcher from implementation of any of the alternatives.

Sensitive Species

Spotted and Townsend's Big-eared Bat: There would be "no impact" to spotted bat and Townsend's big-eared bat from Alternative 1. The action alternatives "may impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or loss of viability to the population or species". Impacts from the action alternatives include using South Camel gravel source for road work which may affect bat roosting in adjacent limestone cliffs.

Flammulated Owl: There would be "no impact" to flammulated owl from Alternative 1. The action alternatives "may impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or loss of viability to the population or species". Impacts from the action alternatives include possible avoidance of treated areas by flammulated owls.

Northern Goshawk: There would be "no impact" to Northern goshawk from Alternative 1. The action alternatives "may impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or loss of viability to the population or species". Impacts from the action alternatives include potential indirect impact to prey species and project activities within nesting habitat. Alternative 2 would affect 1,162 acres of suitable nesting habitat. Alternative 3 would affect 1,083 acres of suitable nesting habitat. Alternative 4 would affect 795 acres of suitable nesting habitat.

Three-toed Woodpecker: There would be "no impact" to three-toed woodpecker from Alternative 1. The action alternatives "may impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or loss of viability to the population or species". Impacts from the action alternatives include removal of dead trees which

represent a food source for the woodpecker. However, snag retention requirements would allow the woodpecker to use the treated areas.

Transportation

Roads and trails in the area are used for a variety of purposes. Alternative 1 would not impact existing roads and trails. Alternative 2 includes: approximately 1 mile of Forest Development Road construction; 15 miles of Forest Developed Road reconstruction; 8 miles of temporary road construction followed by reclamation; 1 mile of Forest Development Road Construction closed to level 1 maintenance; 4 miles of Forest Development Road reclamation; and 18 miles of nonsystem road and motorized trail reclamation.

The road work in Alternatives 3 and 4 is the same as Alternative 2 except that there would be no Forest Development Road construction, and no resulting classification to maintenance level 1.

Forest visitors can expect minor travel delay due to reconstruction of Forest Development Roads. However, this reconstruction would provide safer and more dependable access. To lessen potential project impacts upon Forest visitors, no hauling would be allowed on weekends, holidays, first nine days of general elk season, and the opening weekend of general deer season.

Alternative 1 has 93 miles of Forest Development Roads, nonsystem roads, and nonsystem motorized trails. These 93 miles of motorized access correlates to a motorized network density of 2.4 miles per square mile within the project area (incorporating Forest Development Roads, nonsystem roads, and nonsystem motorized trails). Implementation of the action alternatives would reduce the motorized access to 70 miles, with a corresponding motorized network density of 1.8 miles per square mile (incorporating Forest Development Roads, nonsystem roads, and nonsystem motorized trails).

Range

Forage would temporarily increase with Alternative 1 in the openings created by the dead and dying spruce trees. When these trees fall to the ground, the production and availability of forage would be less.

Permittees could be impacted by the action alternatives. Sheep and livestock may temporarily be prohibited from harvest areas to assure adequate reforestation. Such a prohibition could last 7 to 10 years for sheep and 15 to 20 years for livestock. This decreased use of suitable rangeland may or may not affect herd size depending upon possible variations in reforestation protection methods, fencing, herding, grazing schedules, or other methods worked out with the permittee.

Short-term impacts to range improvements could occur from project activities. However, project-caused damages would be repaired or the improvement would be replaced.

Visual Landscape

The visual landscape could be affected by timber harvest and roading. In general, increased timber harvest and roading is likely to reduce visual quality of an area. However, the location and characteristics of these activities in context with the existing landscape plays a defining role in determining the overall visual effect. When management-induced changes to the landscape contrast with the existing setting, impacts to the visual resource are the greatest. If management activities blend with the existing landscape setting, they are less visually evident.

Alternative 1 would not change the visual character of the area. All action alternatives would add temporary unnatural characteristics to the landscape, primarily when viewed from the immediate foreground or during and shortly after project implementation. With a more distant perspective or time, the action alternatives should blend with the overall

landscape. The overall blending of project activities is attributable to the selective tree removal of the proposed salvage harvesting, limited road construction, road reclamation, and reforestation. Road reconstruction and maintenance would blend with the overall setting because it would occur within the immediate area of the existing roadway. All alternatives would meet Visual Quality Objectives within the area.

Undeveloped Character

Undeveloped character of the area could be affected by timber harvest and roading. In general, increased timber harvest and roading is likely to reduce undeveloped character. The potential to impact undeveloped character is also related to the yarding system used. Since helicopter yarding typically results in less on-the-ground impacts than ground-based yarding, it would be expected to have impact to undeveloped character.

Some impacts, such as the sounds of project activities, would occur only during the immediate time of the activity. Other impacts, such as tree marking paint, skid trails, and logging slash, would be short term (up to 10 years). And yet, other impacts such as roads and tree stumps would be evident much longer (20 to 40 years).

Alternative 1 has 93 miles of Forest Development Roads, nonsystem roads, and nonsystem motorized trails. These 93 miles of motorized access correlates to a motorized network density of 2.4 miles per square mile within the project area. Implementation of the action alternatives would reduce the motorized access to 70 miles, with a corresponding motorized network density of 1.8 miles per square mile. The reduced access and rehabilitation of an unnatural features, roads and trails, would positively affect undeveloped character.

The overall undeveloped character of the area is not expected to notably change because the types of activities, facilities, recreational experiences, and scenery available will remain essentially the same for all alternatives due to developments and activities that already exist.

Cultural Resources

Access and ground disturbance have the potential to affect cultural resources. However, following the existing Memorandum of Understanding will protect known and subsequently discovered cultural resources. In accordance with the National Historic Preservation Act, a "no effect" determination has been made for all alternatives.

Economics

All alternatives have the same inherent cost associated with the preparation of this document. Additionally, all action alternatives would have implementation costs (i.e. sale preparation, sale administration, post-harvest requirements, road work).

Areas are identified for harvest based on technical operability, environmental acceptability, and the need to remove dead and dying spruce trees as a step in ecosystem rehabilitation. The actual amount of harvest, within modelled parameters, depends upon market conditions which vary through time and by the specifics associated with the authorization instrument (e.g. timber sale contract, service contract, etc.). Increased amounts of helicopter yarding reduces the likelihood that all areas identified for treatment would in fact be harvested.

The cost of helicopter yarding is considerably greater than ground-based yarding - almost 8 times as much (\$270/MBF for helicopter yarding, \$34/MBF for ground-based yarding). While Alternatives 2 and 3 treat the same area (6,530 acres), Alternative 2 would helicopter yard 73 percent (4,798 acres) whereas Alternative 3 would helicopter yard 82 percent (5,348 acres). Alternative 4 would helicopter yard 70 percent of its 3,974-acre treatment area (2,792 acre).

The final interim rule has a notable impact on the project's yarding systems and economics. With the rule: Alternative 2 would be 85 percent helicopter yarding (5,162

acres); Alternative 3 would 92 percent helicopter yarding (5,576 acres); and Alternative 4 would be 87 percent helicopter yarding (3,127 acres). This change to helicopter yarding would increase the project's cost and decrease its marketability.

When the timber to be harvested from each alternative is modelled at a minimum base rate for sale of \$10,000 per million board feet of timber (MMBF), the following revenues would be expected: \$320,000 for Alternatives 2 and 3, and \$200,000 for Alternative 4. With the final interim rule, the following revenues would be expected: \$302,000 for Alternatives 2 and 3, and \$180,000 for Alternative 4. Twenty-five percent of these receipts would go to the affected Counties.

Proportional to the amount of timber harvested, all action alternatives would contribute to employment and income opportunities (i.e. timber sale preparation, logging operations, trucking, timber processing, and post-sale requirements). Induced economic benefits to primary and secondary businesses would also be expected.

Long-term economic benefits would also be expected from the action alternatives. Reforestation efforts would accelerate maturation of the treated spruce stands.

Energy

Energy consumption is represented by the use of petroleum products to run project-related equipment. Energy output is represented by the direct fuel value of the harvested timber. All action alternatives would consume fuel. Calculating energy consumption based upon the amount of timber expected to be recovered: Alternatives 2 and 3 could consume 165,193 Millions of British Thermal Units (MMBTU), and Alternative 4 could consume 121,824 MMBTU. However, fuel consumption by helicopter yarding at the high elevations of the project area would be greater than that of ground-based yarding. Therefore, Alternative 3 (with 73% helicopter yarding) would be expected to consume slightly more energy than Alternative 2 (with 82% helicopter yarding). Alternatives 2 and 3 could have an energy output of 204,063 MMBTU, and Alternative 4 could have an energy output of 150,490 MMBTU.

Roadless Character

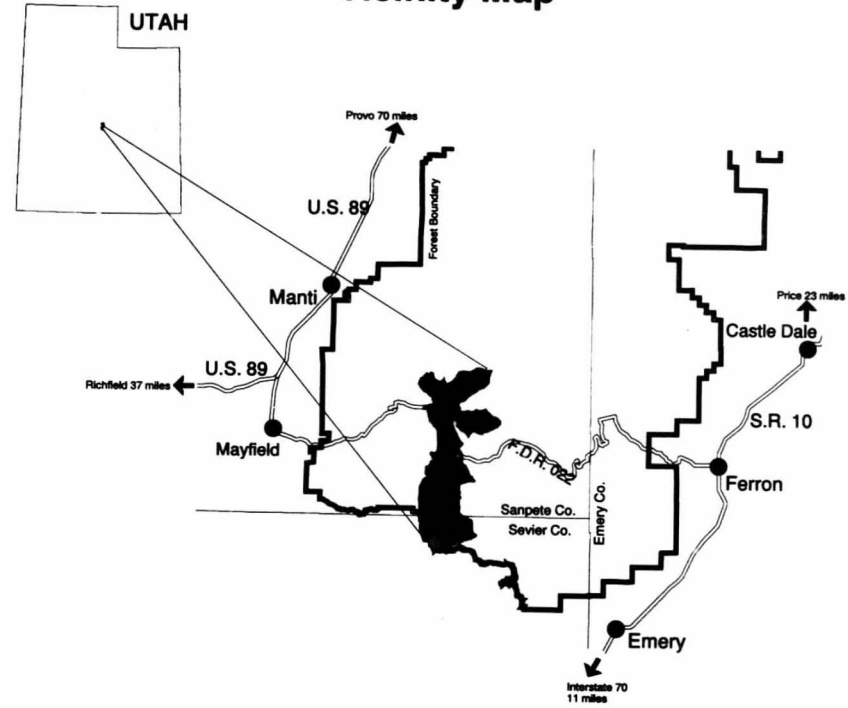
Alternative 1 would have no direct or indirect effects to roadless character, ongoing public use and activities could cumulatively affect roadless character.

Roading can reduce an area's roadless character. None of the action alternatives would construct permanent or temporary roads within RARE II inventoried roadless areas. Alternative 2 is the only alternative that includes road construction (1 mile) within a Forest Plan inventoried roadless area (Heliotrope). This road construction is within an existing road corridor. Alternatives 2 and 3 include road maintenance (0.8 miles) within the Heliotrope inventoried roadless area. Road reclamation can improve an area's roadless character. All action alternatives would reclaim Forest Development Road #50285 within the Heliotrope inventoried roadless area (1 mile). All action alternatives would also reclaim some nonsystem roads and nonsystem motorized trails within inventoried roadless areas (3 miles).







Timber harvest can reduce an area's roadless character. Alternatives 2 and 3 would harvest 2,542 acres within inventoried roadless areas. However, the yarding methods, and corresponding effects, differ between these alternatives. In Alternative 2, yarding within inventoried roadless areas would be by helicopter (79%) and ground-based systems (21%). Impacts from ground-based yarding are usually more evident than aerial yarding. In Alternative 3, yarding within inventoried roadless areas would wholly be by helicopter. Alternative 4 would not harvest within inventoried roadless areas.

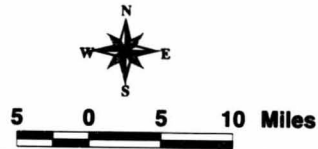
Vicinity Map

FIGURE S-1



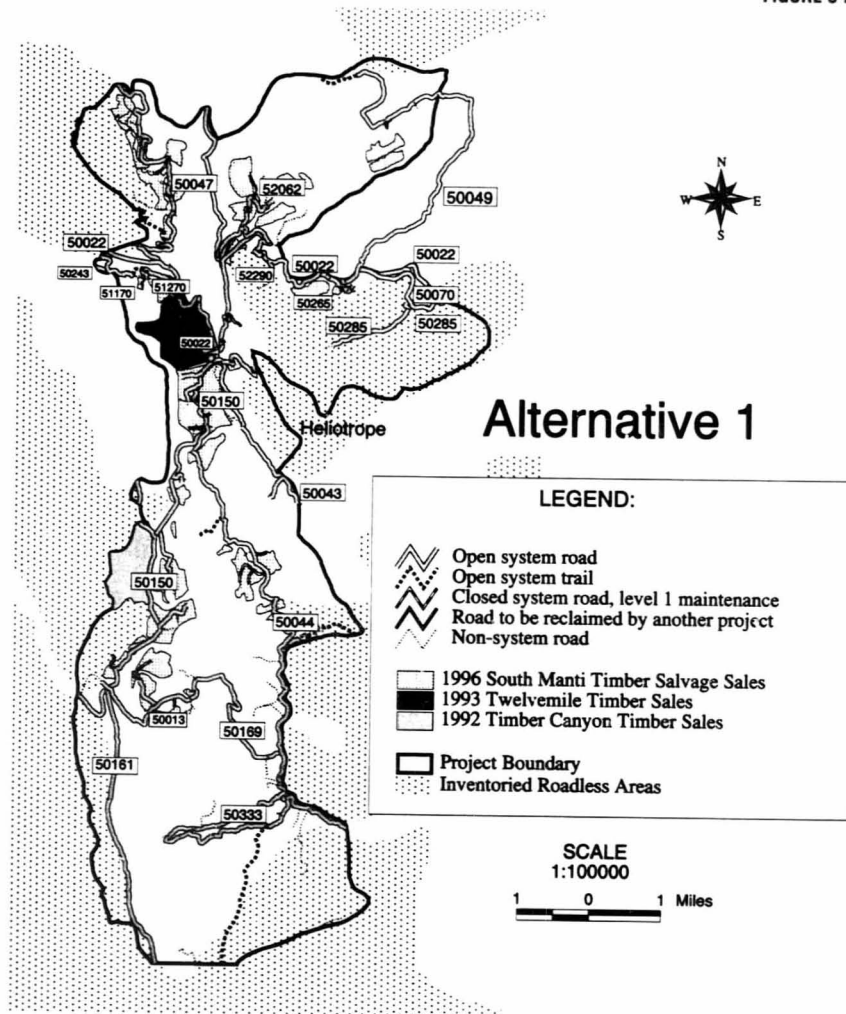
LEGEND:

-  Project Area
-  Towns
-  Roads
-  Manti-La Sal National Forest Boundary
-  County Boundaries
-  Project Boundary



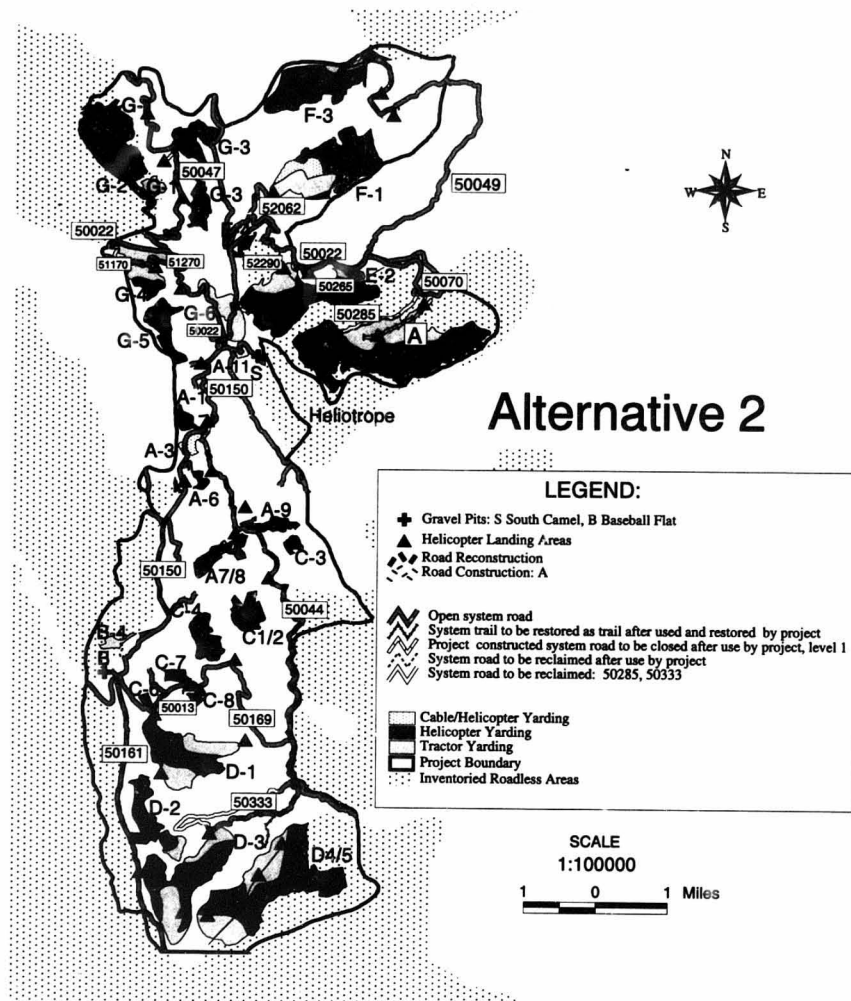
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FIGURE S-2



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FIGURE S-3

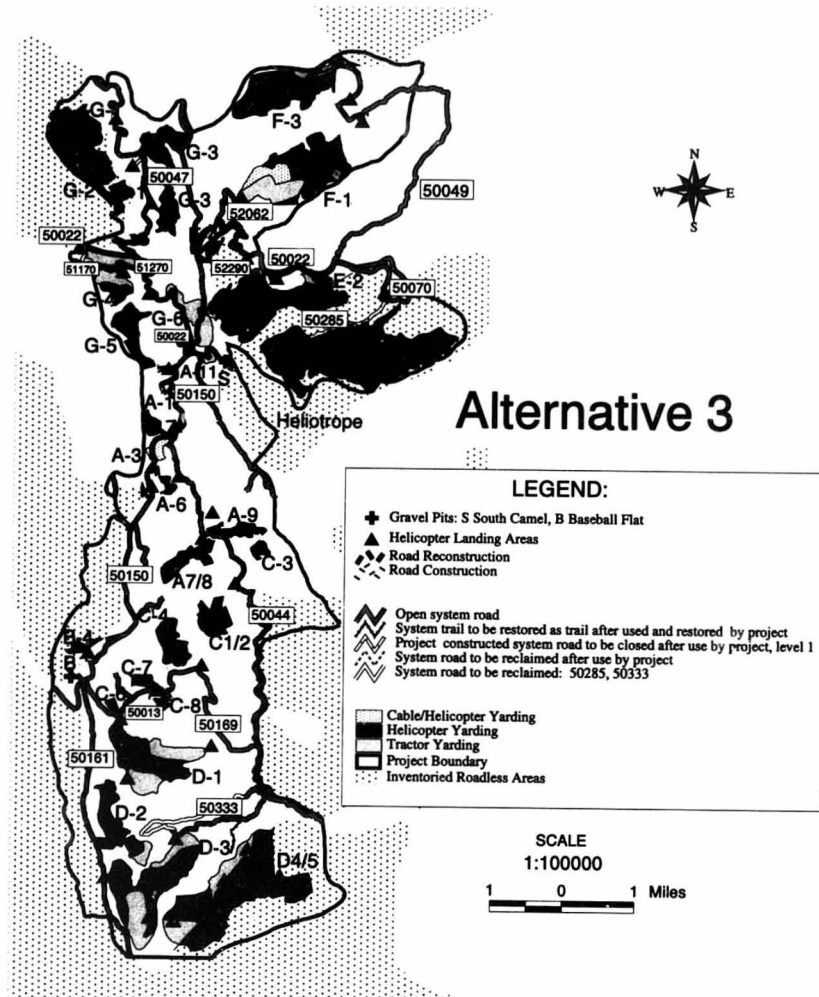


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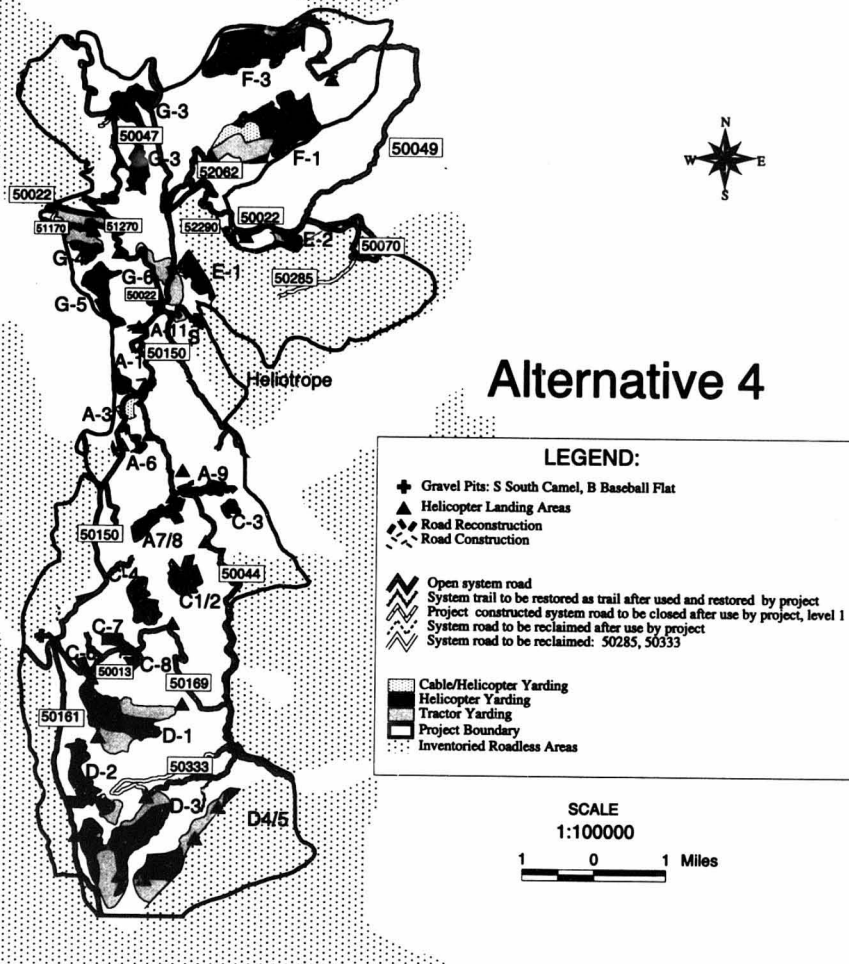
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FIGURE S-4



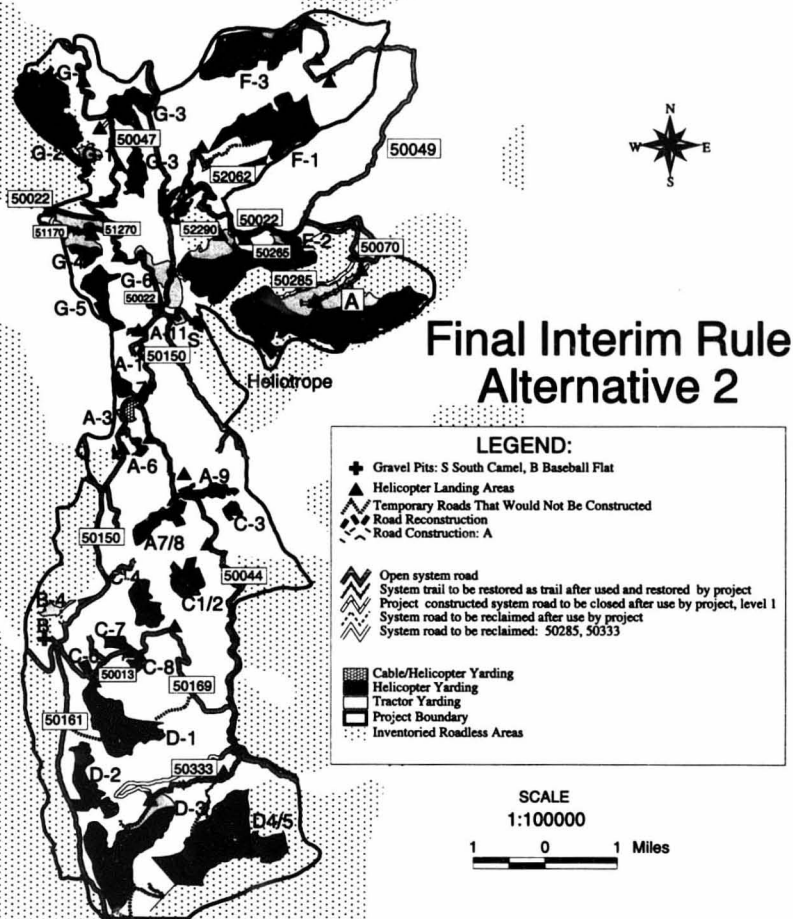
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FIGURE S-5



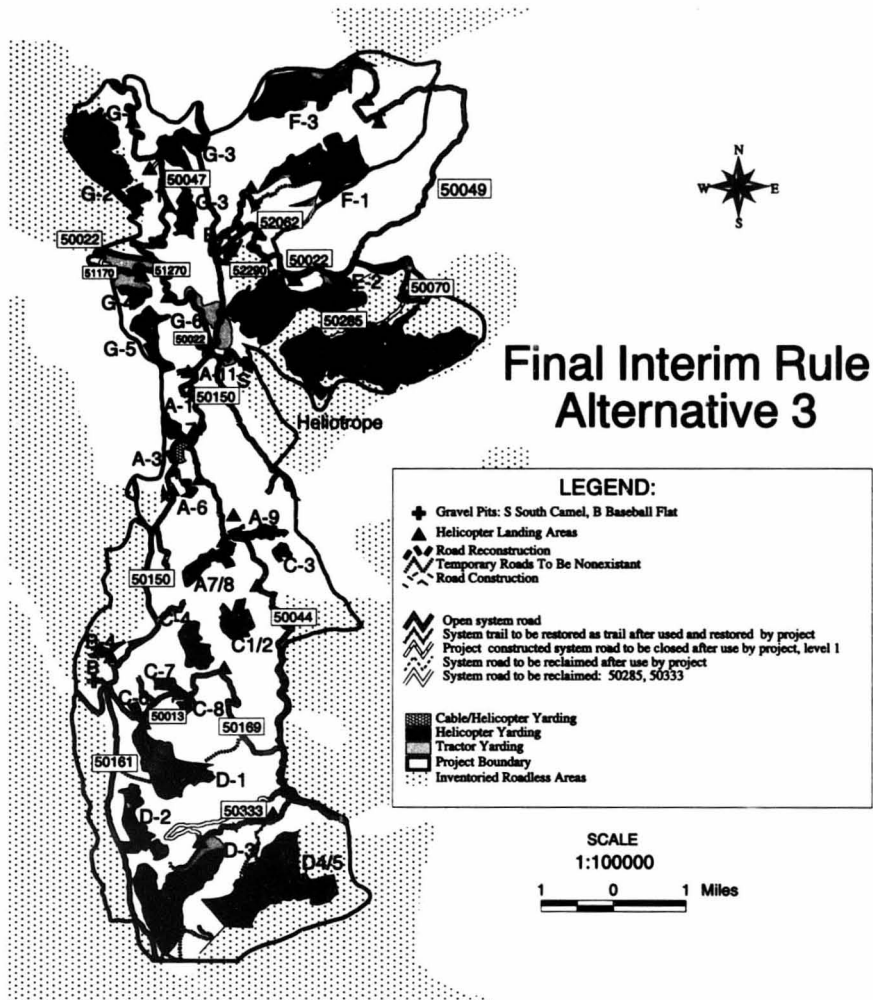
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FIGURE S-10



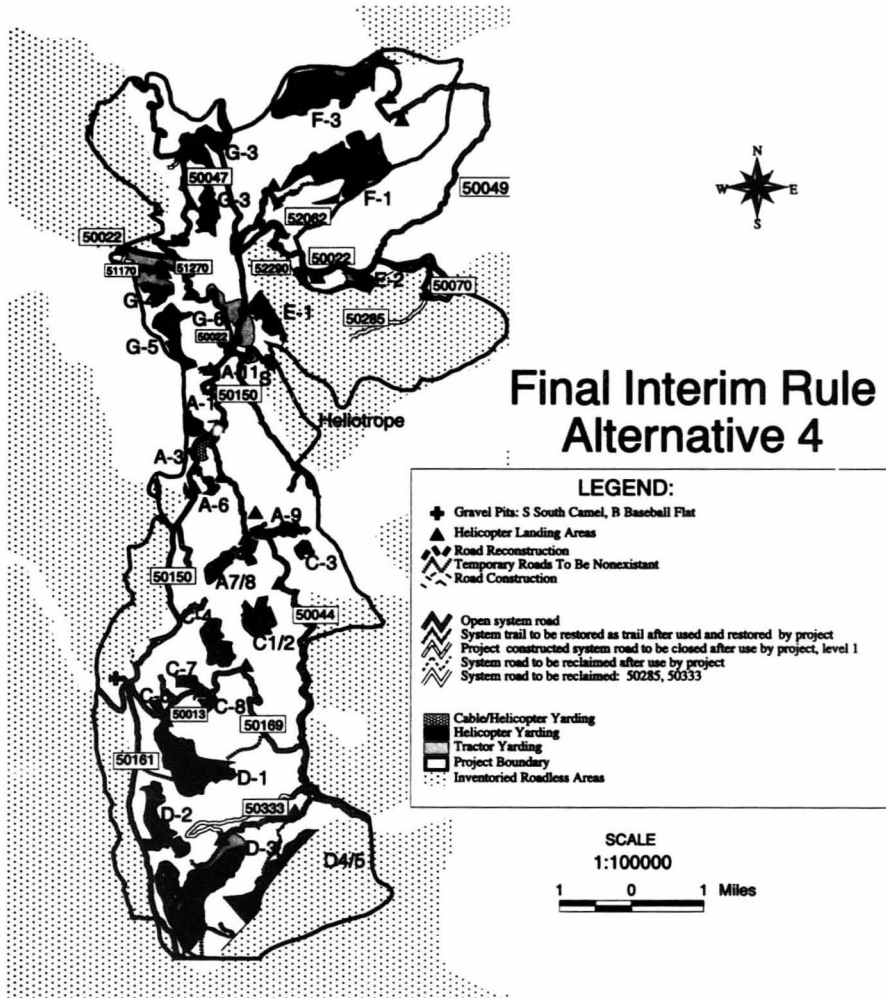
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FIGURE S-11



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FIGURE S-12



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CHAPTER 1

PURPOSE AND NEED

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CHAPTER 1 - PURPOSE OF AND NEED FOR ACTION

1.0 INTRODUCTION

This project was initiated in response to epidemic spruce beetle (*Dendroctonus rufipennis*) activity across the South Manti landscape. This environmental impact statement summarizes potential direct, indirect, and cumulative effects of corresponding site-specific forest management alternatives on portions of the Ferron-Price and Sanpete Ranger Districts of the Manti-La Sal National Forest. The disclosure of information in this document is intended to provide a meaningful basis for public review.

This chapter is divided into the following sections:

- 1.0 Introduction
- 1.1 Proposed Action
- 1.2 Purpose and Need
- 1.3 Incorporation by Reference
- 1.4 Scope of the Project
- 1.5 Decisions to be Made
- 1.6 Document Organization

Proposal

A proposal was designed to address the purpose of and need for action identified in Section 1.2. The proposal included salvage harvest of dead and dying spruce trees, road work, and reforestation responsive to spruce beetle activity in the project area.

A "Notice of Intent to Prepare an Environmental Impact Statement" was printed in the *Federal Register*, which is distributed nationally, on February 17, 1998. The Notice of Intent described the proposal and requested public comment. Local comments on the proposal were requested by newspaper notices in the counties of Carbon, Emery, and Sanpete, Utah. Additional comments were sought by notice in the Forest's *Schedule of Proposed Actions* and by mailing of individual letters. On October 5, 1998, a field trip was held to explain the proposed action to interested publics and gain their input.

Alternatives

Forest management alternatives considered for this project are described in detail in Chapter 2.

Following field verification and review of received comments, the original proposal (February 17, 1998) was modified and is included in this document as Alternative 2. Alternative 2 represents the intent of the original proposal. Alternative 2 proposes salvage harvest of dead and dying spruce trees, road work, and reforestation across the project area, outside and within inventoried roadless areas (RARE II and Forest Plan). Alternative 2 does not include road construction or reconstruction in RARE II inventoried roadless areas - it does include road construction and road maintenance in a Forest Plan inventoried roadless area (Heliotrope).

Two other action alternatives were developed to address the significant issue identified from public comments, while responding to the identified purpose and need for action:

Alternative 3 - Alternative 3 emphasizes achieving the identified purpose and need without constructing or reconstructing roads in inventoried roadless areas (RARE II and Forest Plan) or using ground-based log yarding in such areas;

Alternative 4 - Alternative 4 emphasizes minimizing impact to the character of inventoried roadless areas (RARE II and Forest Plan) by not harvesting, constructing roads, or reconstructing roads in such areas.

Several other alternatives were considered as part of this planning effort, but were not given detailed study for various reasons (refer to Section 2.3 in Chapter 2).

Project Location

The project area is located within the southern portion of the Wasatch Plateau on the Ferron-Price and Sanpete Ranger Districts of the Manti-La Sal National Forest, in Sanpete and Sevier Counties, Utah (Townships 19, 20, and 21 South; Range 4 East; SLM). The project area is approximately 10 miles southeast of the town of Manti, 12 miles east of the town of Mayfield, 19 miles west of the town of Ferron, and 45 miles southwest of the town of Price. The project area extends from White Mountain, along the Manti-La Sal and Fishlake National Forest boundaries, north to the headwaters of Ferron and Sixmile drainages. (See Figure 1-1 Vicinity Map, on page 1-3)

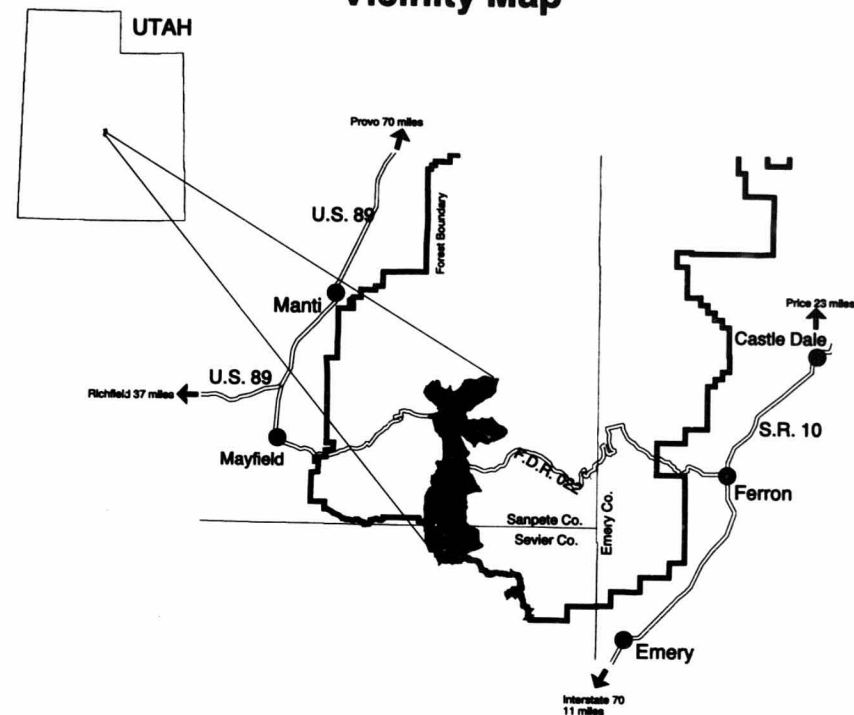
Area Overview

The project area includes approximately 24,597 acres of National Forest System lands. Five characteristics stand out when visiting the South Manti area:

1. **Visual Landscape** - The project area is characterized by a mountainous terrain which includes rock formations and glacial cirques. There are panoramic ridges and valley views (some containing lakes or reservoirs) of subalpine scenery.
2. **Vegetation** - Vegetation in the project area is represented predominantly by three cover types: Engelmann spruce-Subalpine fir (47%), grass and brush (36%), and aspen (12%).
3. **Spruce Beetle** - The Engelmann spruce-Subalpine fir cover type represents over 10,000 acres in the project area. A spruce beetle epidemic has affected most of the spruce trees within the project area. As a result, most spruce trees are dead or dying. Dead trees are those spruce trees in which the flow of nutrients in the cambium/phloem layer, beneath the bark, has ceased. These trees may or may not look dead, depending upon how long they have been dead. Dying trees are those spruce trees with multiple spruce beetle attacks that encircle the tree bole. Dying trees are usually dead within a year of such infestation. Seventy percent of the spruce trees with a diameter greater than five inches at breast height and ninety percent of the spruce trees with a diameter greater than eleven inches at breast height are dead.
4. **Past and Present Management** - There is evidence of past and present management in the area such as grazing, timber harvest, roads, trails, and camping areas which has shaped the overall landscape conditions.
5. **Recreational Use** - Dispersed recreation is the primary recreational use of the area as evidenced by camping areas and road and trail use.

Vicinity Map

FIGURE 1-1



LEGEND:

- Project Area
- Towns
- Roads
- Manti-La Sal National Forest Boundary
- County Boundaries
- Project Boundary



5 0 5 10 Miles

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Summary of Previous Analyses

Recent forest management actions in the project area include timber harvest approved from three separate analyses: Timber Canyon Timber Sale Environmental Assessment (1992), Twelvemile Timber Sale Environmental Assessment (1993), and South Manti Timber Salvage Sales Environmental Assessment (1996). This environmental impact statement reassesses the need for treatment responsive to spruce beetle activity and potential effects of specific, similar management activities within these previously analyzed areas.

The 1992 Timber Canyon Timber Sale Environmental Assessment and its Decision Notice resulted in the harvest of dead, dying, and at-risk spruce trees from 330 acres, recovering approximately 2.9 million board feet (MMBF) of timber. The 1992 Timber Canyon Timber Sale Environmental Assessment project has been completed.

The 1993 Twelvemile Timber Sale Environmental Assessment and its Decision Notice resulted in the harvest of dead, dying, and at-risk spruce trees from 205 acres, recovering approximately 2.4 million board feet (MMBF) of timber. The 1993 Twelvemile Timber Sale Environmental Assessment project has been completed.

Public participation for the 1996 South Manti Timber Salvage Sales Environmental Assessment project began in the fall of 1992 with a public field trip to the area. Participants viewed the extent of spruce beetle activity and beetle-influenced spruce tree mortality. Participants also discussed opportunities to salvage timber and improve forest health. In the summer of 1993, a project proposal was mailed to 82 people, organizations, and agencies. At that time, an environmental assessment was to be prepared to disclose impacts of the proposal. Late in 1993, the Forest Supervisor directed preparation of an environmental impact statement.

On July 27, 1995, the President signed the Rescission Act (Public Law 104-19) which contained provisions related to emergency salvage of timber on lands administered by the Forest Service. The salvage provisions of Public Law 104-19 were intended to expedite timber salvage within a framework of maintaining forest health and ecosystem management. The provisions included use of environmental assessments to disclose project impacts. The authorities provided by Public Law 104-19 were effective until December 31, 1996.

On September 12, 1995, the Forest Supervisor determined that the provisions of Public Law 104-19 applied to the South Manti Timber Salvage Sales. Consistent with the law, the Forest Supervisor redirected the project analysis to production of an environmental assessment. The resulting South Manti Timber Salvage Sales Environmental Assessment and Decision Notice was completed in 1996. The decision approved harvesting dead, dying, and at-risk live spruce trees from across 8,100 acres to recover an estimated 71 million board feet (MMBF) of timber.

Six timber sales were sold from the 1996 South Manti Timber Salvage Sales decision before the authority provided by Public Law 104-19 had expired: Camel, Oley, Olga, Baldy, Six, and Duck. These timber sales were expected to recover approximately 20 million board feet (MMBF) of timber across 1,912 acres. The remaining approved timber harvest was not sold under the existing decision because the authority provided by Public Law 104-19 had expired.

Of the six timber sales sold from the 1996 South Manti Timber Salvage Sales decision, only the Camel Timber Sale has been fully harvested (13 acres, 0.1 MMBF). The Oley Timber Sale (151 acres, 0.9 MMBF) and Olga Timber Sale (173 acres, 1.0 MMBF) are almost complete. Timber harvest started in 1997 on the Baldy Timber Sale (498 acres, 5.9 MMBF) and in 1999 on the Six Timber Sale (351 acres, 4.0 MMBF). Timber harvest is expected to begin in 1999 on the Duck Timber Sale (726 acres, 8.1 MMBF).

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In 1997, the Forest Supervisor made another decision from the 1996 South Manti Timber Salvage Sales Environmental Assessment approving harvest across about 3,860 acres to recover an estimated 22 million board feet (MMBF) of previously analyzed dead, dying, and at-risk timber within the project area, over a time period of five to ten years. That decision was appealed. The decision was reversed by the Regional Forester in his letter of November 7, 1997, because, "... the Responsible Official [Forest Supervisor] did not fully explain why, after expiration of P.L. [Public Law] 104-19, an EIS [environmental impact statement] is not the appropriate level of documentation. ... [and] the new information ... raises questions of a need for additional public comment." In his reversal letter, the Regional Forester also directed preparation of an environmental impact statement to evaluate potential project effects and reflect current conditions.

1.1 PROPOSED ACTION

The "proposed action" is the project's starting point. It reflects the original site-specific proposal developed to respond to the identified purpose and need. It helps to set the scope of the project analysis.

On February 17, 1998, the Forest Service initially proposed to harvest dead and dying Engelmann spruce trees from across approximately 6,600 acres (6,594 acres) in the project area, recovering an estimated by-product recovery of approximately 31 MMBF.

The proposal included approximately 10 miles of road construction and 20 miles of road reconstruction. Of the 10 miles of road construction, 8 miles would be reclaimed after project use and 2 miles would remain as Forest Development Roads. Neither permanent nor temporary roads would be constructed or reconstructed in RARE II inventoried roadless areas. Road construction (approximately 2 miles as mentioned above) and maintenance would occur in a non-RARE II, Forest Plan inventoried roadless area (Heliotrope). Roads used for the project would be maintained as needed.

The proposal also included reestablishment of spruce trees in harvested areas through site preparation, hand planting, and natural seeding from trees remaining within and adjacent to the harvested areas.

1.2 PURPOSE AND NEED

The purpose and need for this project is to address ecological and economic values affected by spruce beetle activity in the South Manti project area as further defined in this section of the document.

Management of the project area is part of the Manti-La Sal National Forest's attempt to fulfill the Forest Service commitment of "caring for the land and serving people". Nationally, the Forest Service has identified a Natural Resource Agenda to reemphasize its commitment of "caring for the land and serving people". The Agenda focuses on four key emphasis areas: watershed health and restoration, sustainable forest ecosystem management, improved management of the National Forest road system, and improved recreation opportunities and experiences. This project embraces the Agenda's goals.

The Manti-La Sal National Forest Land and Resource Management Plan (Forest Plan) identifies goals for the management of the Forest. Goals are concise statements describing a desired condition to be achieved some time in the future. Progress is made toward achieving the goals, and their corresponding desired conditions, through implementation of site-specific projects. Projects are designed to achieve specific goals and move toward desired conditions. The proposed action was designed to help achieve specific goals of the Forest Plan as identified in the following subsections.

Purpose and Need #1 Reduce the potential for large and intense wildfires across forested areas (with associated environmental effects).

Large, intense wildfires can threaten the health of our watersheds and sustainable forest ecosystems. Although insects are a part of the natural cycle, when they are active at epidemic levels they can kill extensive areas of trees. Dead trees represent a fuel source in which a wildfire could burn. An abundance of dead trees can predispose an area to the occurrence of a large, intense wildfire - should a fire start under favorable conditions. A large, intense wildfire can have several undesirable effects ranging from a loss of vegetation and wildlife cover to an overall reduction in site productivity and increased soil erosion and instability. Reducing the amount and continuity of fuel represented by the dead spruce trees would reduce the area's vulnerability to a large, intense wildfire.

This purpose and need for the project is responsive to the following Forest Plan goals.

Timber Goal: "Use timber management to meet other management or resource needs." (Forest Plan, p. III-4).

Protection Goal: "Minimize hazards from ... wildfire ..." (Forest Plan, p. III-5).

Protection Goal: "Reduce the accumulated fuels to a tolerable risk level." (Forest Plan, p. III-5).

Stand-replacement wildfires occur in spruce-fir forests on a 100-year to 300-year cycle, probably associated with other disturbance regimes such as insect epidemics and tree mortality. No substantial wildfires have occurred within the project area during the last 75 years to 100 years. Given the absence of a stand-replacement fire within the last decade, several recent years of drought conditions, and epidemic spruce beetle activity across the landscape, the area is becoming increasingly predisposed to the occurrence of a large-scale wildfire.

Pre-epidemic fuel loadings on the ground were 10 to 15 tons per acre in spruce stands. Most spruce trees within the project area are dead or dying due to spruce beetle activity (seventy percent of the spruce trees with a diameter greater than five inches at breast height and ninety percent of spruce trees with a diameter greater than eleven inches at breast height are dead). These dead trees represent an increase in the amount of potential fuel available to burn in a wildfire. In affected spruce stands, the current average fuel loading on the ground is about 30 tons per acre. Fuel loadings of over 70 tons per acre are expected in the spruce stands as dead trees fall to the ground - more than 7 times greater than pre-epidemic fuel conditions. With such extensive tree mortality and high fuel loadings, there are inherent concerns about the potential for a wildfire to occur, spread rapidly, be difficult to control, and create undesirable effects.

The proposed action responds to this purpose and need through salvage harvest of dead and dying spruce trees. Salvage harvest of dead and dying timber can reduce the fuels available and susceptible to an unmanaged wildfire. This reduction in fuels reduces the risk to other management and resource needs such as maintenance of healthy watersheds and forest ecosystems, and conservation of plant and wildlife species diversity, viability, and habitats.

Purpose and Need #2 Facilitate rapid reestablishment of Engelmann spruce through replanting of spruce in Timber Management Emphasis Units identified in the Forest Plan.

Spruce tree mortality represents a loss of vegetation, biodiversity, and wildlife cover. It also represents the loss of an important seed source for the future. Timber sales can be used as a tool to restore forest ecosystem health. Following timber harvest, site preparation and reforestation efforts help to ensure a future of healthy trees. Trees contribute to the health of the forest and its sustainability. Healthy forests do far more than grow trees for harvest - they provide clean water, wildlife habitat, recreation opportunities, and more.

This purpose and need for the project is responsive to the following Forest Plan goals.

Vegetation Goal: "... varying successional stages will be present to provide for a high level of vegetative diversity and productivity." (Forest Plan, p. III-2).

Timber Goal: "Maintain a healthy Forest by applying appropriate silvicultural treatments." (Forest Plan, p. III-3).

Timber Goal: "Use timber management to meet other management or resource needs." (Forest Plan, p. III-4).

Epidemic outbreaks of spruce beetles and subsequent extensive spruce mortality are not desirable because it dramatically reduces compositional and structural diversity over a relatively short time. With over 90 percent of the mature spruce in affected stands dead, the character of the remaining stands is changed. The character of affected stands is now less varied and more open. The affected stands now consist mostly of smaller subalpine fir and have a smaller average live tree diameter. The spruce trees that have survived the beetle activity are small and poorly distributed across the landscape. They do not represent an ideal seed source. Vegetation in the affected stands will move from an Engelmann spruce-Subalpine fir community toward a community dominated by Subalpine fir, which is the climax species. While beetle epidemics and the trend toward a climax successional stage may be within the historic range of variability, the above stated Forest Plan Vegetation Goal would not be achieved in a timely manner. Without treatment to facilitate reestablishment of spruce, the affected spruce stands will take between 30 and 90 years to regenerate Engelmann spruce to full stocking levels. Without treatment to facilitate reestablishment of spruce, it will also take 100 to 200 years to return to the affected stands to pre-epidemic stocking and production levels, providing the full range of benefits associated with a healthy forest.

The proposed action responds to this purpose and need through salvage harvest of dead and dying spruce trees, followed by site preparation and reforestation treatments. Reforestation provides a dependable assurance of reestablishment of the spruce component in areas that have experienced extensive mortality. Replanting of spruce in the harvested areas assures adequate stocking within 5 years. Replanting of spruce in the harvested areas also reduces the recovery time for the stand to return to pre-epidemic stocking and production levels by 60 to 70 years. These reforested areas would mature sooner than other areas and would increase structural and compositional diversity conditions more rapidly with a greater resilience to disturbance, providing an array of benefits represented by a healthy forest.

Purpose and Need #3 Recover some of the economic value of the dead and dying trees.

While timber harvest can be used as a tool to restore forest ecosystem and watershed health as presented in the preceding purpose and need descriptions, it can also contribute to local economies. Recovery of some of the economic value of dead and dying trees and restoration of healthy forests are beneficial to many rural communities and businesses, as well as recreationists.

Forest roads are an essential part of the transportation system in many rural parts of the country. Forest roads help meet recreation demands, provide economic opportunities by facilitating the transport of products, and provide access for needed management. While the benefits of roads are many, so too are their ecological impacts. Roads not properly built and maintained can do environmental damage. Timber sales can be used as a tool to better manage the road network across the landscape. Old, unneeded roads may be closed or removed while other roads may be maintained or improved through timber sales. These measures provide for improved services, public safety, and environmental protection. Additionally, twenty-five percent of the revenues generated from National Forests are currently returned to states and distributed to counties for schools and county roads - further benefiting the local communities.

This purpose and need for the project is responsive to the following Forest Plan goals.

Timber Goal: "Provide commercial timber sales of sufficient quantity and quality to maintain local timber industry and accomplish desired vegetation treatment goals." (Forest Plan, p. III-3).

Timber Goal: "Meet as much of the demand for wood fiber and Forest products as possible, consistent with multiple-use objectives." (Forest Plan, p. III-3).

Timber Goal: "Use timber management to meet other management or resource needs." (Forest Plan, p. III-4).

About twenty-two percent (5,335 acres) of the project area is allocated specifically to provide for wood fiber production and utilization (Management Unit TBR - Timber Management Emphasis). Another seventy-eight percent (19,112 acres) is allocated to allow for wood utilization consistent with meeting other resource value requirements (Management Unit RNG - Range Emphasis). Epidemic spruce beetle activity in lands allocated to providing long-term, continuous supplies of timber products is not desirable because it results in extensive tree mortality in a short period of time. While the short-term economic benefits of harvesting dead trees are obvious, the long-term economic benefits of promptly reestablishing a healthy stand of trees is often overlooked. Without treatment to facilitate reestablishment of spruce, the affected stands will take 90 to 140 years to reach a commercial age.

The proposed action responds to this purpose and need through salvage harvest of dead and dying spruce trees, site preparation and reforestation treatments, and road work. A salvage harvest of dead and dying timber and associated road work can provide economic opportunities for businesses and individuals. Demands for lumber and other building products are increasing as more people move into Utah and the Western United States and more homes are built. Continued competition and demand for sawtimber and houselogs is reasonably foreseeable in the next decade. Reforestation efforts would accelerate maturation of the affected spruce stands, thereby better ensuring long-term productivity and potential economic benefits.

1.3 INCORPORATION BY REFERENCE

To decrease the size of this document and the degree of redundancy to the contents of other documents, some material in this document tiers to or incorporates by reference other material.

Material specifically cited or otherwise used in preparation of this document is hereby incorporated by reference.

Information in this document tiers to the direction contained in the Forest Plan, as amended, and its Record of Decision (1986). Information in the Forest Plan Final Environmental Impact Statement is hereby incorporated by reference.

Recent previous analyses in Wasatch Plateau spruce/fir zones on the Ferron/Price and Sanpete Ranger Districts are also incorporated by reference. These analyses include: Timber Canyon Timber Sale Environmental Assessment (1992), Twelvemile Timber Sale Environmental Assessment (1993), and South Manti Timber Salvage Sales Environmental Assessment (1996).

Information, analyses, and literature incorporated by reference in the 1996 South Manti Timber Salvage Sale Environmental Assessment previous analyses are hereby incorporated by reference as appropriate.

The entirety of the supporting project record is hereby incorporated without further reference.

The project record is available for review at the Forest Supervisor's Office, Manti-La Sal National Forest, 599 West Price River Drive, Price, Utah, 84501.

1.4 SCOPE OF THE PROJECT

The scope of a project refers to the geographic boundaries of the proposal including any connected or cumulative actions. The scope of actions addressed in this document is limited to specific treatment of spruce stands affected by beetle activity, timber harvest, access management, reforestation, and post-sale activities.

This document does not constitute a general management plan for the area. It discloses and evaluates potential effects that could be caused by the site-specific alternatives considered in detail. The project's scope of analysis is confined to the issues associated with the proposed action and includes all lands that may reasonably be affected from implementation of the alternatives. This analysis considers the need for potential amendments to the Forest Plan and associated effects.

1.5 DECISIONS TO BE MADE

The Responsible Official, Forest Supervisor of the Manti-La Sal National Forest, will make the following decisions associated with this document:

1. Whether to harvest dead and dying trees and, if so, the location, methods of harvest, silvicultural diagnosis, reforestation, and post-sale activities;
2. Whether to change short-term and/or long-term access and, if so, the location, methods of road construction, reconstruction, maintenance, rehabilitation, closure, and access management;
3. What, if any, additional measures are necessary to implement a decision;
4. What, if any, specific project monitoring requirements are needed to assure selected measures are implemented and effective; and,
5. Whether Forest Plan Amendments are needed to implement a decision.

1.6 DOCUMENT ORGANIZATION

Chapter 1 - Chapter 1 presents an introduction to the project and project area, the purpose and need for action, the proposed action, material incorporated by reference, the scope of the project, and the decisions to be made.

Chapter 2 - Chapter 2 describes the alternative development process and resulting alternatives. Four alternatives considered in detail (including 'no action') and alternatives not given detailed study are described in Chapter 2. Chapter 2 also discusses ways of addressing or resolving issues related to implementation of the action alternatives. The alternatives are displayed so that a comparison can be made of the alternative components, accomplishment of the purpose and need, and potential environmental effects.

Chapter 3 - Chapter 3 discusses the affected environment and provides a frame of reference from which to judge the effects of each alternative.

Chapter 4 - Chapter 4 discloses the effects of implementing each alternative. Direct/indirect and cumulative effects are presented by resource topic. Consistency with the Forest Plan is also presented. Potential conflicts with plans and policies of other jurisdictions, probable environmental effects that cannot be avoided, relationship between short-term use and long-term productivity, irreversible and irretrievable commitments of resources, and specifically required disclosures are presented at the end of Chapter 4.

Appendices - The Appendices contain site-specific or supplementary information that may add depth to the discussions in the main chapters.

CHAPTER 2 ALTERNATIVES

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CHAPTER 2 - ALTERNATIVES

2.0 INTRODUCTION

This chapter describes in detail four alternative ways to manage the land and resources in the South Manti project area. A team of resource specialists (see Appendix A - List of Preparers) developed these alternatives within the framework of the Forest Plan and ecological stewardship. Alternatives were designed to address or resolve the issues identified from public involvement. A key design requirement of each action alternative was that it had to respond to the purpose and need for the project identified in Chapter 1.

This chapter is divided into the following sections:

- 2.0 Introduction
- 2.1 Alternative Development Process
- 2.2 Issue Identification
- 2.3 Alternatives Considered But Not Given Detailed Study
- 2.4 Alternatives Considered in Detail
- 2.5 Comparison of Alternatives

A description of the project area potentially affected by the alternatives is found in Chapter 3. The potential consequences of implementing each alternative are found in Chapter 4. A comparative summary of the alternatives and their effects is presented in Section 2.5 at the end of this chapter.

2.1 ALTERNATIVE DEVELOPMENT PROCESS

Alternative development is strongly driven by public comments.

Public comments were sought on the February 1998 proposal. Comments were sought by various means including notice in the *Federal Register*, newspapers, the Forest's *Schedule of Proposed Actions*, by individual letters, and a field trip. A detailed summary of public involvement efforts and results is contained in Appendix B - Public Involvement.

Twenty-two letters were received in response to the Forest's public involvement efforts. The letters were from individuals, organizations, private businesses, and natural resource management agencies. The contents of each letter were analyzed by a team of resource specialists (see Appendix B - Public Involvement).

The National Environmental Policy Act states that all Federal agencies shall, "... study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflict concerning alternative uses of available resources." A team of resource specialists reviewed the comments and identified issues that could help with analysis, project design, and development of alternative actions.

Some of the comments received were of a general nature and do not need to be further addressed. Other comments expressed concerns that required a discussion of potential effects, incorporation of specific design features to better implement the project, or the development of an alternative. Comments that warranted additional discussion or specific design features were categorized as nonsignificant issues. Comments that warranted the development of an alternative were categorized as significant issues.

2.2 ISSUE IDENTIFICATION

Issues are derived from review of the proposed action that was developed in response to the identified purpose and need. From the public comments received, fifteen issues were identified. These issues are the basis for the project analysis, project design features, alternatives, and overall disclosure of information in this document and supporting project record.

One issue, relative to the proposed action, was found to be a significant issue in that it was a basis from which to develop alternatives - Issue #15, Impacts to Roadless Character.

Issues

The following fifteen issues were identified. Each issue is explained by a brief statement of the concern. Key comparison elements are identified for each issue. These elements are useful in evaluating how alternatives respond to the issue and the potential effects of each alternative. The discussion of effects in Chapter 4 addresses the identified key comparison elements and other pertinent information. Additional and supporting information is maintained in the project record at the Manti-La Sal National Forest Supervisor's Office.

1. **Impacts to Air Quality** - Timber harvest and associated activities could have short-term effects on air quality.

Key Comparison Elements:

- Relationship to State air quality standards (compliance).

2. **Impacts to Land Stability** - The North Horn Formation in the area, loose rock material overlying the formation, and soils derived from the formation are naturally unstable. Road construction and reconstruction could reduce land stability and induce landslides. Landslides could damage resources. Reforestation could improve land stability.

Key Comparison Elements:

- Road construction in unstable and moderately unstable areas (miles).
- Road reconstruction in unstable and moderately unstable areas (miles).
- Harvest/reforestation in unstable and moderately unstable areas (acres).

3. **Impacts to Soil Erosion and Productivity** - Timber harvest and associated activities could compact or displace soil. Compacted and displaced soil could be subject to erosion and loss of productivity. Different log yarding methods have different soil-related effects. Road construction and reconstruction could displace soil and temporarily remove the land from resource production.

Key Comparison Elements:

- Bare soil by log yarding method (percent of harvest area, acres).
- Erosion potential of ground-based yarding areas (acres of low, moderate, high).
- Road construction (new and temporary) and reconstruction (miles).

4. **Impacts to Water Resources (Water Quantity and Quality; Riparian/Wetlands; Aquatic Habitat; Aquatic Species)** - Timber harvest, associated activities, and road work could impact the quantity and quality of water resources. Surface water resources could be altered, diverted, and depleted. Water quality could be affected in terms of sedimentation, stream temperature, and water chemistry.

Aquatic habitat and species are dependent on water quantity, water quality, and healthy riparian and wetland systems. Timber harvest, associated activities and road work, and changes in water quantity and quality could affect riparian and wetland systems, and habitat.

Key Comparison Elements:

Water Quantity

- Water yield (percent increase in mean annual flow).

Water Quality

- Surface water sources affected (number).
- Vegetation disturbed by skid trails, landings, and roads (acres).
- Sediment yield from surface erosion (maximum percent increase).
- Sediment yield from in-channel erosion (degree of change).
- Long-term sediment yield from road reclamation (degree of change).

Riparian and Wetland Systems

- Road construction and reconstruction across perennial streams (number).

Aquatic Habitat

- Stream habitat impacts from water and sediment yields (degree of impact).

5. **Impacts to Vegetation Resources (Forest Health, Diversity, and Productivity: Noxious Weeds: Sensitive Plant Species)** - The spruce beetle epidemic has altered the vegetative condition of the landscape. The majority of spruce trees are dead or dying from spruce beetle activity. Timber harvest could remove dead and dying spruce trees. Reforestation could facilitate reestablishment of spruce.

Timber harvest and road work disturbs soil. Disturbed soil provides an ideal opportunity for weed seed to germinate. Vehicles, people, and animals could transport noxious weed seed that could become established.

No threatened or endangered plant species or their habitat would be affected. Timber harvest, associated activities, and road work could affect sensitive plants or their habitat.

Key Comparison Elements:

Forest Health, Diversity, and Productivity

- Dead/dying spruce stands harvested and reforested, planting and natural (acres).
- Dead/dying spruce stands harvested and reforested by planting (acres).
- Spruce recovery rate in beetle-infested spruce stands (years to full stocking, years to commercial age, years to pre-epidemic conditions).

Noxious Weeds

- Soil disturbance (acres).

Sensitive Plant Species

- Carrington Daisies (impact determination).
- Arizona Willow (impact determination).
- Musine Groundsel (impact determination).
- Maguire Campion (impact determination).

6. **Impacts to Fuel Loading and Fire Risk** - The majority of spruce trees are dead or dying from spruce beetle activity. These dead trees have increased the amount of fuel, and corresponding wildfire risks, across the landscape. As more trees die, the amount of fuel increases. The potential risk of an unmanageable wildfire could increase with an increase in fuels. Timber harvest could remove dead and dying spruce trees, thereby reducing the amount of fuel and associated wildfire potential.

Key Comparison Elements:

- Fuel reduction (acres harvested).
- Post-treatment fuel loading (remaining tons/acre in treated areas).
- Wildfire potential (risk rating).

7. **Impacts to Wildlife Resources (Forest Management Indicator Species: Tree Cavity Dependent Species: Threatened, Endangered, and Sensitive Animal Species)** - Timber harvesting and road work could alter the habitat, behavior, and risk of mortality of management indicator species, tree cavity dependant species, threatened species, endangered species, and sensitive species.

Management indicator species are species identified in the Forest Plan to represent a variety of species and habitats. Effects to management indicator species, reflect anticipated effects to representative species (e.g. raptors, squirrels, chipmunks, hares, rabbits, bears, porcupines, badgers) and their habitats. The following terrestrial management indicator species use the project area: elk, mule deer, blue grouse, and golden eagles.

The following proposed, threatened, and endangered species may be influenced by the project: Canada lynx, bald eagle, peregrine falcon, and southwest willow flycatcher. The following Forest Service sensitive species may be influenced by the project: spotted bat and Townsend's big-eared bat, flammulated owl, Northern goshawk, and three-toed woodpecker.

Key Comparison Elements:

Management Indicator Species

- **Elk and Deer:** Hiding and foraging habitat (acres).
- **Elk and Deer:** Vulnerability and use of available habitat (road density).
- **Blue Grouse:** Wintering habitat, Douglas-fir stands affected (acres).
- **Golden Eagles:** Prey base (availability)

Tree Cavity Dependent Species

- Snag habitat affected (acres).

Proposed, Threatened, and Endangered Species

- Canada Lynx - Proposed Threatened (effect determination).
- Bald Eagle - Threatened (effect determination).
- Peregrine Falcon - Endangered (effect determination).
- Southwest Willow Flycatcher - Endangered (effect determination).

Sensitive Species

- Spotted bat and Townsend's big-eared bat (impact determination).
- Flammulated Owl (impact determination).
- Northern Goshawk (impact determination).
- Three-toed Woodpecker (impact determination).

8. **Impacts to Transportation System, Access, Visitor Safety, and Travel Delays** - Road work affects the transportation system and access opportunities. Road work and hauling timber on publicly used roads could impact Forest users in terms of safety and travel times. Project-related traffic could conflict with recreational traffic.

Key Comparison Elements:

Transportation System and Access

- Forest Development Road construction and reconstruction (miles).
- Reclamation of Forest Development Roads and nonsystem roads (miles).
- Post-project Forest Development Road, nonsystem road, and motorized trail access (miles).
- Post-project Forest Development Road, nonsystem road, and motorized trail density (miles per square mile).

User Safety and Travel Delays

- Conflicts with recreationists (summer and winter logging traffic vehicles/day).
- Delays in travel from logging traffic and associated road work (extent).

9. **Impacts to Range Allotments and Improvements** - Timber harvest, associated activities, and road work could affect the operation of range allotments and existing range improvements, such as springs and fences.

Key Comparison Elements:

- Suitable rangeland restricted for timber regeneration (acres).
- Livestock restrictions (reduction in head months, duration of restriction).
- Range improvements affected (number).

10. **Impacts to Visual Landscape** - The spruce trees, averaging about 70 percent of the mixed-conifer forest visual landscape, have been infested by spruce beetles. These beetles have killed the majority of the spruce trees. As the spruce trees die, the foliage appearance changes from green to red to yellowish-green. As the yellowish-green needles drop from the tree, only the grey background of dead branches remain. Timber harvest would remove some of these dead trees. Timber harvest and road work could further alter the visual landscape and affect visitors' experiences as seen from roadways, dispersed and developed recreation areas, campgrounds, lakes, and reservoirs.

Key Comparison Elements:

- Post-activity visual quality condition (relationship to visual quality objective).

11. **Impacts to Undeveloped Character** - Timber harvest, associated activities, and road work could impact the undeveloped character of the landscape.

Key Comparison Elements:

- Scenic condition (landscape alteration, relationship to visual quality objective).
- Recreation experience (change to recreation opportunity spectrum).
- Motorized access network (miles of roaded access, roaded access density).

12. **Impacts to Cultural Resources** - Timber harvest and associated activities could affect cultural resources.

Key Comparison Elements:

- Potential to affect paleontological/cultural resources (treatment acres).
- Expected prehistoric sites within unsurveyed harvest units (number).
- Effect to prehistoric sites (effect determination).
- Effect to historic sites (effect determination).
- Known sites eligible for National Register of Historic Places (number).

13. **Impacts to Economics** - Timber harvesting and associated activities may affect the economies of local communities and contribute to the National treasury.

Key Comparison Elements:

- Projected employment (number of jobs, created income).
- Payment in lieu of taxes to Counties (dollars).
- Economic efficiency (present net value, benefit/cost ratio).

14. **Impacts to Energy** - Timber harvest and associated activities consume fuel.

Key Comparison Elements:

- Fuel consumption and output (Millions of British thermal units).

15. **Impacts to Roadless Character** - Timber harvest, associated activities, and road work could impact inventoried roadless areas (RARE II and Forest Plan) and their roadless characteristics.

Key Comparison Elements:

- Direct impacts to inventoried roadless areas (harvest acres, road construction)
- Post-activity roadless character (narrative on natural integrity, apparent naturalness, remoteness, solitude, special features, and manageability).

Significant Issue

Most issues are resolved through incorporation of laws, regulations, policy, or specific design features. Issue #15 represents a concern resulting from the proposed action that is not so readily resolved. Correspondingly, it is referred to as a significant issue that is used to develop alternatives for potential resolution of the concern. This significant issue was used by the team of resource specialists to develop alternatives to the proposed action.

2.3 ALTERNATIVES CONSIDERED BUT NOT GIVEN DETAILED STUDY

Several alternatives to the proposed action were identified, considered, and eliminated from detailed study for various reasons. These alternatives are summarized below along with an explanation of why they were not further given detailed study.

- Harvesting areas of spruce trees beyond those presented in the proposed action were not given detailed study because field review raised logging feasibility and economics concerns, as well as additional resource concerns.
- Road construction, permanent and temporary, in RARE II inventoried roadless areas was not given detailed study because of current social values and the ability to meet the project's purpose and need without such additional roading. Correspondingly, extensive ground-based yarding in RARE II inventoried roadless areas was not given detailed study because of limited access.
- Yarding and hauling of harvested timber from the southern end of the project area (D treatment areas) primarily through Millfork/Blackfork drainages (Forest Development Roads #50333 and #50044) was not given detailed study because analysis showed costs would not be feasible in comparison to yarding and hauling, in combination, across the top of Baseball Flat (Forest Development Road #50161) and through the Millfork/Blackfork drainage.
- Under current conditions and conditions expected for the next several years, prescribed fire without prior treatment such as timber harvest to reduce the fuel loading was not given detailed study for several reasons (e.g. fire behavior of burning areas with heavy concentrations of dead trees is unpredictable, the ability to control and extinguish a fire would be unlikely, and unacceptable effects would be expected such as killing live trees, removing an important seed source for reforestation, and reducing big-game security habitat). Additionally, prescribed fire has a limited time of opportunity under which a fire could be managed to meet desired conditions.
- Aspen stand management was not given detailed study because it is not responsive to the project's purpose and need. Additionally, impacts of aspen removal, to stimulate new sprouts would be undesirable at this time because it would further reduce hiding cover and security habitat for deer and elk. Aspen planting was also not given detailed study because its success is limited by site characteristics not prevalent in the treatment areas. However, the proposed action and action alternatives account for the presence of aspen in the harvest areas.

- An alternative using cable yarding systems on slopes greater than 40 percent instead of helicopter was considered. Although some areas are topographically suitable for cable yarding and cable yarding is more cost efficient than helicopter yarding, it was not given area-wide detailed study because of potential adverse effects - including environmental and economic consequences of building roads on steep, unstable slopes. However, helicopter yarding areas with adequate existing access for cable yarding are identified and included in the action alternatives with an option for cable yarding.
- Reclassification of suitable timberland was not given detailed study because it is beyond the project's scope and would not affect achievement of the purpose and need or respond to an identified issue.
- Based upon additional field review and public comment, the original proposal of February 17, 1998, has been modified as presented in Alternative 2. Therefore, the original proposal has been dropped from further consideration.

2.4 ALTERNATIVES CONSIDERED IN DETAIL

A no action alternative (Alternative 1) and three action alternatives (Alternatives 2, 3, and 4) were developed and considered in detail. These alternatives represent a reasonable range of alternatives for this project that sharply define the significant issue, while responding to the identified purpose and need. Each alternative has specific impacts associated with how they achieve the purpose and need for the project.

All action alternatives (Alternatives 2, 3, and 4) include Forest Plan direction and project design features that address various issues, reduce potential environmental effects, and allow for improving project implementation. All applicable Forest Plan direction is hereby incorporated by reference unless otherwise stated (refer to Appendix C - Forest Plan Direction). The project design features are listed by issue topic in Appendix D - Project Design Features.

Alternative 1 - No Action

Alternative 1 addresses the requirement to provide a "No Action" alternative. This alternative would not salvage harvest dead and dying spruce from the area as a result of this planning effort at this time. No corresponding treatments to reduce fuel loading would occur as a result of this planning effort at this time. No roads would be constructed, reconstructed, closed, or reclaimed related to this project. Reforestation would be through natural processes.

Figure 2-1 Alternative 1 Map, on page 2-21, displays information about management characteristics of the area.

Current management would continue (e.g. road maintenance, roadside fuelwood and post and pole permits, activities under special use permits, grazing permits, and fire suppression).

Existing uses and trends would be expected to continue.

The effects resulting from this alternative can be used as a reference condition with which to compare the effects of implementing the other alternatives.

Alternative 2 - Proposed Action (Modified)

Relationship to Purpose and Need

Alternative 2 addresses the identified purpose and need by reducing the fuel loading across 6,530 acres, facilitating rapid reestablishment of spruce trees through planting harvested areas within Timber Management Emphasis Units identified in the Forest Plan, and recovering some economic value of the dead and dying trees (32 to 42 MMBF).

Alternative 2 Development

Following field verification and review of received comments, the original proposal (February 17, 1998) was modified and is included in this document as Alternative 2. Alternative 2 meets the intent of the original proposal. Alternative 2 includes the following modifications to the proposed action.

- Treatment Area Protected for Goshawk Habitat: Approximately 64 acres have been dropped from treatment consideration because of the presence of goshawk nests in the previously identified areas A5 (14 acres) and the eastern part of F3 (50 acres).
- Conversion of Helicopter Yarding to Optional Cable Yarding: Approximately 115 acres of helicopter yarding was changed to helicopter with optional cable yarding adequate access exists (A3 (39 acres) and F1 (76 acres)).
- Conversion of Helicopter Yarding to Ground-based Yarding: Approximately 113 acres of helicopter yarding have been changed to ground-based yarding because adequate ground access exists (E2 (31 acres) and F1 (82 acres)).
- Conversion of Ground-based Yarding to Helicopter Yarding: Approximately 414 acres of ground-based yarding have been changed to helicopter yarding because of terrain features and inadequate access (D1 (214 acres) and E3 (200 acres)).
- Reduction in Road Construction: Approximately 1 mile of road construction has been dropped due to field relocation of the proposed road to better fit terrain and protect a riparian area (road access into Treatment Unit E3 within the Heliotrope Forest Plan inventoried roadless area).
- Reclamation of Forest Development Roads: Approximately 4 miles of Forest Development Road have been added for reclamation to protect soil and water resources and because the roading is not needed for management of Forest resources (50285 (1.4 miles) and 50333 (2.6 miles)).
- Addition of Temporary Road Construction Followed by Reclamation: The proposed access to the northeast side of Treatment Unit D1 was not long enough to reach the unit. An additional half mile of temporary road construction followed by reclamation has been identified to access the unit.

Commercial Treatment Activities

Figure 2-2 Alternative 2 Map, on page 2-23, displays the key components of this alternative. Figure 2-5, on page 2-13, summarizes key features of this alternative. Additional alternative information is in Appendix E - Unit Information, and Appendix F - Road Information.

Commercial Treatment Acreage: Alternative 2 would salvage harvest dead and dying spruce trees across approximately 6,530 treatment acres. Past experience indicates that 50 to 65 percent of the treatment area is likely to be harvested (3,200 to 4,200 acres). The actual harvest acreage is less than the treatment area because of stand and site conditions (e.g. areas of non-spruce tree species, natural openings, meadows, rock outcrops), resource protection (riparian areas, steep slopes, unstable ground), and economic feasibility.

Location of Commercial Treatment: Approximately 3,988 treatment acres are located outside of inventoried roadless areas. Approximately 1,070 treatment acres are located within RARE II inventoried roadless areas. Approximately 1,472 treatment acres are located within a Forest Plan inventoried roadless area (Heliotrope).

RARE II Inventoried Roadless Areas

Harvest would occur in three RARE II inventoried roadless areas: Black Mountain, Twelve Mile, and White Mountain. This is reflected by treatment areas: B4, D4/5, G1, and G2.

Forest Plan Inventoried Roadless Areas

Harvest would occur in the Heliotrope Forest Plan inventoried roadless area. This is reflected by treatment areas: E1, E2, E3, and E4.

Type of Commercial Treatment: All tree removal would be by a selective salvage harvest of dead and dying spruce trees. Felled timber would be yarded from within the unit to landing areas by various yarding methods: ground-based (1,617 acres), cable/helicopter option (115 acres), and helicopter (4,798 acres).

Conventional ground-based yarding systems such as tractor or rubber-tired skidders would be used on accessible slopes less than 40 percent. On slopes greater than 40 percent where access is not a problem, yarding would optionally be by either cable or helicopter in all of A3 and part of F1. On the remaining area where slopes are greater than 40 percent and/or access is not readily available, helicopter yarding would be used.

Ground-based yarding would apply to units: A11, B4, D1, D2, D3, D4/5, E1, E2, E3, F1, F3, G1, G4, and G6. Optional cable/helicopter yarding would apply to units: A3 and F1. Helicopter yarding would apply to units: A1, A6, A7/8, A9, C1/2, C3, C4, C6, C7, C8, D1, D2, D3, D4/5, E1, E2, E3, E4, F1, F3, G1, G2, G3, G4, and G5.

By-Product Recovery: With an estimated by-product recovery of 10 thousand board feet (MBF) per acre, approximately 32 to 42 million board feet (MMBF) of timber could be recovered. Actual recovered volume may vary depending upon stand and market conditions at the time of implementation, and if all timber were sold.

Timing: This alternative would take approximately 6 calendar years to implement the removal of included timber through multiple timber sales. The normal operating season would be July 1st to October 1st. Associated fuel reduction and initial reforestation activities (scarification and planting) would be completed within 1 to 2 years after harvest operations.

Transportation System

Roads would be required for project activities such as harvest implementation, post-harvest activities, reforestation, monitoring, and fuelwood management.

The following road work has been identified as part of this alternative: Forest Development Road construction (1 mile); Forest Development Road reconstruction (15 miles); constructed Forest Development Road closed to Level 1 maintenance (1 mile); project temporary roads to be built and reclaimed (8 miles); Forest Development Roads to be reclaimed (4 miles); and; nonsystem roads and motorized trails to be reclaimed (18 miles). Road and trail reclamation would occur as funds become available.

Some of the identified road work would be in inventoried roadless areas.

RARE II Inventoried Roadless Areas

No permanent or temporary road work would occur in RARE II inventoried roadless areas.

Forest Plan Inventoried Roadless Areas

Road construction (Forest Development Road (1 mile)) and road maintenance (Forest Development Roads #50070 (0.5 miles) and #50285 (0.3 miles)) would be allowed in the Heliotrope Forest Plan inventoried roadless area. The included road maintenance would make the specified roads suitable for hauling timber.

Forest Development Road, nonsystem road, and nonsystem motorized trail density would decrease from 2.4 miles of road/trails per square mile to 1.8 miles of road/trails per square mile after full implementation of the project. Approximately 70 miles of roads and trails would remain open to motorized use after full implementation of the project. No system motorized trails would be permanently closed that are currently open.

Gravel for road work and maintenance would be obtained from one of two approved sites (South Camel, Baseball Flat) or off-Forest sources.

Post-Harvest Activities

Post-harvest fuels would be reduced across 6,530 acres by hand or with ground-based equipment. Activities would include piling and burning, prescribed jackpot burning, and/or logging and scattering.

Natural (1,888 acres) and artificial (planting) (1,133 acres) reforestation activities would be used to restock harvested areas as needed. Natural reforestation may include machine scarification of the site. Gopher populations would be reduced as necessary using properly applied lethal methods of strychnine to assure reforestation success. Gopher control treatment has been estimated for approximately 1,246 acres. Permitted sheep and livestock would be managed to protect reforestation from unacceptable damage.

Current management in the area would continue, including removal of fuelwood using existing roads.

Alternative 3 - Relationship to Purpose and Need

Alternative 3 addresses the identified purpose and need by reducing the fuel loading across 6,530 acres, facilitating rapid reestablishment of spruce trees through planting harvested areas within Timber Management Emphasis Units identified in the Forest Plan, and recovering some economic value of the dead and dying trees (32 to 42 MMBF).

Relationship to Significant Issue

Alternative 3 is responsive to Issue #15 (Impacts to Roadless Character) by: 1) not allowing road construction, reconstruction, or temporary roads in inventoried roadless areas; 2) allowing only helicopter yarding in inventoried roadless areas, and; 3) not allowing mechanical fuels reduction or site preparation in inventoried roadless areas.

Commercial Treatment Activities

Figure 2-3 Alternative 3 Map, on page 2-25, displays the key components of this alternative. Figure 2-5, on page 2-13, summarizes key features of this alternative. Additional alternative information is in Appendix E - Unit Information, and Appendix F - Road Information.

Commercial Treatment Acreage: Alternative 3 would salvage harvest dead and dying spruce trees across the same 6,530 acres as Alternative 2. The actual harvest acreage (3,200 to 4,200 acres) is less than the treatment area for the same reasons as Alternative 2.

Location of Commercial Treatment: The location of treatment areas are the same as for Alternative 2, both outside of and within inventoried roadless areas.

Type of Commercial Treatment: Like Alternative 2, all tree removal would be by a selective salvage harvest of dead and dying spruce trees. Differing from Alternative 2, harvest within inventoried roadless areas would require helicopter yarding. Felled timber would be yarded from within the unit to landing areas by various yarding methods: ground-based (1,067 acres), cable/helicopter option (115 acres), and helicopter (5,348 acres). Ground-based yarding would apply to units: A11, D1, D2, D3, D4/5, E1, E2, F1, F3, G4, and G6. Optional cable/helicopter yarding would apply to units: A3 and F1. Helicopter yarding would apply to units: A1, A6, A7/8, A9, C1/2, C3, C4, C6, C7, C8, D1, D2, D3, D4/5, E1, E2, E4, F1, F3, G1, G2, G3, G4, and G5.

Alternative 3 may require more areas for helicopter landing areas than Alternative 2.

By-Product Recovery: The estimated timber volume that could be recovered would be the same as Alternative 2, if all areas were treated. Because of the increased amount of helicopter yarding, market conditions and economics may not support the sale of all timber.

Timing: Alternative 3 could take as long as Alternative 2 to complete under the same conditions (up to 6 years to harvest followed by 2 years of post-harvest activity).

Transportation System

Road management would be similar to Alternative 2 except that it would not construct 1 mile of Forest Development Road in the Heliotrope Forest Plan inventoried roadless area. Like Alternative 2, road maintenance would be allowed in the Heliotrope Forest Plan inventoried roadless area (Forest Development Roads #50070 (0.5 miles) and #50285 (0.3 miles)).

Post-Harvest Activities

Alternative 3's post-harvest activities are the same as Alternative 2, except that there would be no mechanical fuels reduction or site preparation within inventoried roadless areas. Hand treatment of site and fuels would have to be used within inventoried roadless areas.

Alternative 4 - Relationship to Purpose and Need

Alternative 4 addresses the identified purpose and need by reducing the fuel loading across 3,974 acres, facilitating rapid reestablishment of spruce trees through planting harvested areas within Timber Management Emphasis Units identified in the Forest Plan, and recovering some economic value of the dead and dying trees (20 to 26 MMBF).

Relationship to Significant Issue

Alternative 4 is responsive to Issue #15 (Impacts to Roadless Character) by not allowing timber harvest and road construction in inventoried roadless areas - RARE II and Forest Plan. Timber harvest and associated activities (e.g. road construction/reconstruction, mechanical site preparation) within inventoried roadless areas are not a part of this alternative.

Commercial Treatment Activities

Figure 2-4 Alternative 4 Map, on page 2-27, displays the key components of this alternative. Figure 2-5, on page 2-13, summarizes key features of this alternative. Additional alternative information is in Appendix E - Unit Information, and Appendix F - Road Information.

Commercial Treatment Acreage: Alternative 4 would salvage harvest dead and dying spruce trees across approximately 3,974 treatment acres. Past experience indicates that 50 to 65 percent of the treatment area is likely to be harvested (2,000 to 2,600). The actual harvest acreage is less than the treatment area for the same reasons as Alternative 2.

Location of Commercial Treatment: The location of treatment areas are the same as for Alternative 2, except that no harvest would occur within inventoried roadless areas.

Type of Commercial Treatment: Like Alternative 2, all tree removal would be by a selective salvage harvest of dead and dying spruce trees. Felled timber would be yarded from within the unit to landing areas by various yarding methods: ground-based (1,067 acres), cable/helicopter option (115 acres), and helicopter (2,792 acres). Ground-based yarding would apply to units: A11, D1, D2, D3, D4/5, E2, F1, F3, G4, and G6. Optional cable/helicopter yarding would apply to units: A3 and F1. Helicopter yarding would apply to units: A1, A6, A7/8, A9, C1/2, C3, C4, C6, C7, C8, D1, D2, D3, D4/5, E1, E2, F1, F3, G3, G4, and G5.

By-Product Recovery: With an estimated by-product recovery of 10 thousand board feet (MBF) per acre, approximately 20 to 26 million board feet (MMBF) of timber could be recovered. Actual recovered volume may vary depending upon stand and market conditions at the time of implementation, and if all timber were sold.

Timing: This alternative could take approximately 5 calendar years to implement the removal of included timber through multiple timber sales. The normal operating season would be July 1st to October 1st. Associated fuel reduction and initial reforestation activities (scarification and planting) would be completed within 1 to 2 years after harvest operations.

Transportation System

Same as Alternative 3, except that no road maintenance associated with timber harvest would occur within inventoried roadless areas.

Post-Harvest Activities

Same as Alternative 2, except less acres would be treated. Fuel reduction would occur across 3,974 acres. Natural (1,160 acres) and artificial (planting) (696 acres) reforestation activities would be used to restock harvested areas as needed. Gopher control treatment has been estimated for approximately 766 acres.

Figure 2-5 Alternative Summary ¹.

Description	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Treatment Area (acres)	0	6,530	6,530	3,974
Log Yarding Method across Treatment Area:				
Ground-Based (acres)	0	1,617	1,067	1,067
Cable/Helicopter (acres)	0	115	115	115
Helicopter (acres)	0	4,798	5,348	2,792
Treatment Area Harvested ² (acres)	0	3,200 to 4,200	3,200 to 4,200	2,000 to 2,600
By-Product Recovery ³ by Yarding Method:				
Timber Recovered by Ground-Based Yarding (MMBF)	0	7.9 to 10.5	5.4 to 6.9	5.4 to 6.9
Timber Recovered by Cable/Helicopter Yarding (MMBF)	0	0.6 to 0.7	0.6 to 0.7	0.6 to 0.7
Timber Recovered by Helicopter Yarding (MMBF)	0	23.5 to 31.2	26.0 to 34.8	14.0 to 18.1
Roads:				
FDR ⁴ Construction (miles)	0	1	0	0
FDR Reconstruction (miles)	0	15	15	15
Temporary Construction followed by Reclamation (miles)	0	8	8	8
FDR Construction to Level 1 Maintenance ⁵ (miles)	0	1	0	0
FDR Reclamation (miles)	0	4	4	4
Nonsystem Road and Motorized Trail Reclamation (miles)	0	18	18	18
Post-project Road and Motorized Trails ⁶ (miles)	93	70	70	70
Post-project Road and Motorized Trail Density ⁶ (miles/miles ²)	2.4	1.8	1.8	1.8
Reforestation:				
Artificial Reforestation - Planting (acres)	0	1,133	1,133	696
Natural Reforestation (acres)	0	1,888	1,888	1,160
Natural Reforestation Site Preparation (acres)	0	877	877	539
Reforestation Protection - Gopher Control (acres)	0	1,246	1,246	766

1. Key components expected over 5 to 8 years if an alternative is fully implemented.
2. Approximately 50 to 65 percent of the treatment area is likely to be harvested.
3. Based on estimated timber by-product recovery of 10 MBF per harvest acre.
4. FDR is the abbreviation for "Forest Development Road", also referred to as a system road.
5. Conversion to level 1 maintenance after use by project is the same FDR road segment as that proposed for construction.
6. Includes FDR, nonsystem roads, and nonsystem motorized system trails.

2.5 COMPARISON OF ALTERNATIVES

Comparison by Final Interim Rule

This section compares the alternatives considered in detail. Information in this section is based upon presentation of the alternatives earlier in this chapter and the resource information detailed in Chapters 3 and 4. Based on this information, the Responsible Official and the public should be able to compare how different alternatives address the purpose and need, respond to the issues, and affect resources.

The first comparison between alternatives to be aware of is their association to the Agency's March 1, 1999 final interim rule which temporarily suspends decision making on road construction and reconstruction in many unroaded areas within the National Forest System. This rule is in effect until a revised policy is issued or 18 months from the effective rule date, whichever is sooner. The interim rule would affect the action alternatives considered in detail: less acreage could reasonably be treated (430 to 482 acres less); more treatment would have to be accomplished using helicopter logging (375 to 448 acres more); less road in need of repair would not be reconstructed (4 miles less); less temporary road construction followed by reclamation would occur (8 miles less); and less timber by-products would be recovered (2 to 3 MMBF less). A brief description of these changes by alternative are presented below. Summary details of the changes are presented in Figure 2-6 Unit Changes from Final Interim Rule, Figure 2-7 Rooding Changes from Final Interim Rule, and Figure 2-8 Alternative Results from Final Interim Rule. The resulting alternative changes from the final interim rule are mapped in Figures 2-9 through 2-11, on pages 2-29 through 2-33.

Final Interim Rule Impact to Alternative 2

Alternative 2 would be affected by the Agency's final interim rule of March 1, 1999. Of the 6,530 acres identified for treatment, 482 acres could not be reasonably treated. Approximately 372 acres of identified ground-based yarding would have to be treated using helicopter yarding to accomplish the project's purpose and need. Approximately 76 acres of identified optional cable yarding would have to be treated using helicopter yarding to accomplish the project's purpose and need. Approximately 4 miles of Forest Development Road reconstruction and 8 miles of temporary road construction followed by reclamation would not occur. Landing areas affected by these changes would be relocated or dropped. The identified road construction within the Forest Plan inventoried roadless area (Heliotrope) would still be permissible as it is within a roaded corridor. These changes in treatment would result in a reduced estimated by-product recovery of 30 to 39 MMBF, instead of 32 to 42 MMBF.

Final Interim Rule Impact to Alternative 3

Alternative 3 would be affected by the Agency's final interim rule of March 1, 1999. Of the 6,530 acres identified for treatment, 482 acres could not be reasonably treated. Approximately 301 acres of identified ground-based yarding would have to be treated using helicopter yarding to accomplish the project's purpose and need. Approximately 76 acres of identified optional cable yarding would have to be treated using helicopter yarding to accomplish the project's purpose and need. Approximately 4 miles of Forest Development Road reconstruction and 8 miles of temporary road construction followed by reclamation would not occur. Landing areas affected by these changes would be relocated or dropped. These changes in treatment would result in a reduced estimated by-product recovery of 30 to 39 MMBF, instead of 32 to 42 MMBF.

Final Interim Rule Impact to Alternative 4

Alternative 4 would be affected by the Agency's final interim rule of March 1, 1999. Of the 3,974 acres identified for treatment, 430 acres could not be reasonably treated. Approximately 301 acres of identified ground-based yarding would have to be treated through helicopter yarding to accomplish the project's purpose and need. Approximately 76 acres of identified optional cable yarding would have to be treated through helicopter yarding to accomplish the project's purpose and need. Approximately 4 miles of Forest Development Road reconstruction and 8 miles of temporary road construction followed by reclamation would not occur. Landing areas affected by these changes would be relocated or dropped. These changes in treatment would result in a reduced estimated by-product recovery of 18 to 23 MMBF, instead of 20 to 26 MMBF.

Figure 2-6 Unit Changes from Final Interim Rule ¹.

TREATMENT UNIT	TREATMENT AREA DROPPED	
	ground-based	helicopter
F-1, All Alternatives	41 acres (central and west)	
D-1, All Alternatives	93 acres (all at north)	
D-2, All Alternatives	30 acres (all)	
D-3, All Alternatives		
D-4/5, Alternative 2	134 acres (all at south)	84 acres (partial at south)
D-4/5, Alternative 3	69 acres (all at south)	149 acres (partial at south)
D-4/5, Alternative 4	69 acres (all at south)	42 acres (partial at south)

TREATMENT UNIT	TREATMENT CHANGE TO HELICOPTER	
	ground-based	cable/helicopter
F-1, All Alternatives		76 acres (all)
D-1, All Alternatives	81 acres (all at south)	
D-2, All Alternatives		
D-3, All Alternatives	131 acres (all at south)	
D-4/5, Alternative 2	160 acres (all at north)	
D-4/5, Alternative 3	89 acres (all at north)	

¹ Refer to Figures 2-2 through 2-4, on pages 2-21 through 2-27, for treatment unit mapping without final interim rule, and Figures 2-9 through 2-11, on pages 2-29 through 2-33, for treatment unit mapping with final interim rule.

Figure 2-7 Rooding Changes from Final Interim Rule ¹.

AREA	ROAD WORK DROPPED
All Alternatives	4 miles reconstruction off FDR #50161
F-1, All Alternatives	0.3 miles temporary road construction followed by reclamation off FDR #52062
D-1, All Alternatives	1.5 miles temporary road construction followed by reclamation off FDR #50161 and #50169
D-2 & 3, All Alternatives	0.8 miles temporary road construction followed by reclamation off FDR #50333
D-3 & 4, All Alternatives	3.3 miles temporary road construction followed by reclamation off FDR #50161
D-4/5, All Alternatives	1.9 miles temporary road construction followed by reclamation off FDR #50333

¹ Refer to Figures 2-2 through 2-4, on pages 2-21 through 2-27, for road work mapping without final interim rule, and Figures 2-9 through 2-11 on pages 2-29 through 2-33, for road work mapping with final interim rule.
² FDR is the abbreviation for "Forest Development Road", also referred to as system road.

Figure 2-8 Alternative Results from Final Interim Rule ¹.

Description	Alternative 2	Alternative 3	Alternative 4
Treatment Area (acres)	6,048	6,048	3,599
Log Yarding Method across Treatment Area:			
Ground-Based (acres)	847	433	433
Cable/Helicopter (acres)	39	39	39
Helicopter (acres)	5,162	5,576	3,127
Treatment Area Harvested ² (acres)	3,024 to 3,391	3,024 to 3,391	1,800 to 2,330
Treatment Area Harvested by Log Yarding Method:			
Ground-Based (acres)	424 to 551	217 to 281	217 to 281
Cable/Helicopter (acres)	20 to 25	20 to 25	20 to 25
Helicopter (acres)	2,581 to 3,355	2,788 to 3,624	1,564 to 2,075
By-Product Recovery ³ by Yarding Method:			
Timber Recovered by Ground-Based Yarding (MMBF)	4.2 to 5.5	2.2 to 2.8	2.2 to 2.8
Timber Recovered by Cable/Helicopter Yarding (MMBF)	0.2 to 0.3	0.2 to 0.3	0.2 to 0.3
Timber Recovered by Helicopter Yarding (MMBF)	25.8 to 33.6	27.9 to 36.2	15.6 to 20.7
Roads:			
FDR ⁴ Reconstruction (miles)	11	11	11
Temporary Construction followed by Reclamation (miles)	0	0	0

¹ Key components expected over 5 to 8 years if an alternative is fully implemented. Minor differences may exist between associated components due to rounding of values during calculations.
² Approximately 50 to 65 percent of the treatment area is likely to be harvested.
³ Based on estimated timber by-product recovery of 10 MMBF per harvest acre.
⁴ FDR is the abbreviation for "Forest Development Road", also referred to as a system road.

Comparison by Purpose and Need

The following Figure 2-12 Comparison of Alternatives by Purpose and Need without Final Interim Rule, summarizes the relationship of each alternative to the identified purpose and need. The values presented in Figure 2-12, do represent all the facets of the alternatives considered. For a comprehensive understanding of the alternatives, refer to Chapter 4.

The reduced treatment acreages associated with the final interim rule would reduce the project's responsiveness to the purpose and need: less area would be treated to reduce the potential for large/intense wildfire, less area would have rapid reestablishment of spruce; and less timber by-products would be recovered. Additionally, the final interim rule would require more treatment to be accomplished using helicopter logging instead of ground-based or cable. The resulting project would consist of 85 percent to 92 percent helicopter yarding. This change to helicopter yarding would increase the project's costs and reduce its marketability.

Figure 2-12 Comparison of Alternatives by Purpose and Need without Final Interim Rule

Purpose and Need	Alternative 1	Alternative 2	Alternative 3	Alternative 4
#1 Reduced Potential for Large/Intense Wildfires				
- Acres Treated to Reduce the Amount of Fuel	0	6,530	6,530	3,974
- Wildfire Potential Risk Rating	high	low	low-mod	mod
#2 Rapid Spruce Reestablishment by Planting in Timber Mgmt. Emphasis Units (TBR)				
- Years to Full Stocking ¹ of Spruce <u>without</u> Planting	30 to 90	30 to 90	30 to 90	30 to 90
- Years to Full Stocking ¹ of Spruce <u>with</u> Planting	N/A	5	5	5
- Acres Planted ² in TBR Areas Treated	0	400	400	240
- Years to Pre-epidemic Conditions <u>without</u> Planting	100 to 200	100 to 200	100 to 200	100 to 200
- Years to Pre-epidemic Conditions <u>with</u> Planting	N/A	30 to 40	30 to 40	30 to 40
#3 Economic Recovery of Dead and Dying Trees				
- Timber By-Product Recovered (MMBF)	0	32 to 42	32 to 42	20 to 26
- Expected Revenue from Timber By-Product	0	\$320,000	\$320,000	\$200,000
- Twenty-five Percent Sale Revenues to Counties	0	\$80,000	\$80,000	\$50,000
- Years to Commercial Age ³ <u>without</u> Planting	80 to 140	80 to 140	80 to 140	80 to 140
- Years to Commercial Age ³ <u>with</u> Planting	N/A	70 to 100	70 to 100	70 to 100

1. Full stocking exists when there are 3 to 5 trees per acre.
2. Planting needs were identified through inventory data and modelling.
3. To be considered commercial, the average stand diameter would have to be at least 8 to 10 inches in diameter at breast height.

Comparison by Issues

The following Figure 2-13 Comparison of Alternatives by Issue without Final Interim Rule, summarizes values associated with the issue key comparison elements for the alternatives considered in detail. For a full understanding of what the issue comparison elements values mean refer to Chapter 4. Unless otherwise noted, potential changes associated with the final interim rule would result in slightly less environmental effects, proportional to the acreage treated and amount of road work, than those disclosed in the following issue comparison.

The values presented in Figure 2-13 Comparison of Alternatives by Issue without Final Interim Rule, are in reference to effects resulting from or associated with the alternatives considered in detail. The values presented in Figure 2-13 Comparison of Alternatives by Issue without Final Interim Rule, do not present externally-generated potential cumulative effects, such as those that might occur from a wildfire across the landscape.

Figure 2-13 Comparison of Alternatives by Issue without Final Interim Rule

ISSUE	Alternative 1	Alternative 2	Alternative 3	Alternative 4
ISSUE #1 - AIR QUALITY				
Relationship to State requirements (compliance)	yes	yes	yes	yes
ISSUE #2 - LAND STABILITY				
Road construction in unstable and moderately unstable areas (miles)	0	1.1	0	0
Road reconstruction in unstable and moderately unstable areas (miles)	0	10.4	9.7	9.7
Harvest/reforestation in unstable and moderately unstable areas (acres)	0	3,910	3,910	2,499
ISSUE #3 - SOIL EROSION AND PRODUCTIVITY				
Bare soil from helicopter yarding (acres in helicopter landings)	0	30	30	26
Bare soil from ground-based yarding (acres)	0	323	213	213
Low erosion potential of ground-based yarding areas (acres)	0	693	503	434
Moderate erosion potential of ground-based yarding areas (acres)	0	911	551	620
High erosion potential of ground-based yarding areas (acres)	0	13	13	13
Road construction, new and temporary (miles)	0	9	8	8
Road reconstruction (miles)	0	15	15	15
ISSUE #4 - WATER RESOURCES				
Water Quantity:				
Water yield at points of cumulative effects (% increase in mean annual flow)	1 to 3%	1 to 3%	1 to 3%	1 to 3%
Water yield in subwatersheds (% increase in mean annual flow)				
Muddy Watershed: Greens Hollow, Mill Fork, Black Fork, Emerald, North Fk.	≥ 10%	≥ 10%	≥ 10% ¹	≥ 10% ¹
Ferron Watershed: Duck Fork, Ferron	≥ 10%	≥ 10%	≥ 10% ¹	≥ 10% ¹
Water Quality:				
Surface water sources affected from road/stream crossings (number)	0	18	14	14
Vegetation disturbed by skid trails, landings, and roads (acres)	0	353	243	239
Sediment yield from surface erosion (max. percent increase from existing)	0%	8%	11%	6%
Sediment yield from in-channel erosion (degree of change)	increase	increase ²	increase ²	increase ²
Long-term sediment yield from road reclamation (degree of change)	none	decrease	decrease	decrease
Riparian and Wetland Systems:				
Road construction/reconstruction across perennial streams (number)	0	18	14	14
Aquatic Habitat:				
Stream habitat impacts from water and sediment yields (degree of impact)	least	greatest	2 nd greatest	3 rd greatest
ISSUE #5 - VEGETATION RESOURCES				
Forest Health, Diversity, and Productivity:				
Dead/dying spruce stands harvested and reforested, planted/natural (acres)	0	3,200 to 4,200	3,200 to 4,200	2,000 to 2,600
Dead/dying spruce stands harvested and reforested by planting (acres)	0	1133	1133	696
Spruce recovery rate without planting (years to full stocking ³)	30 to 90	30 to 90	30 to 90	30 to 90
Spruce recovery rate with planting (years to full stocking ³)	N/A	5	5	5
Spruce recovery without planting (years to pre-epidemic condition)	100 to 200	100 to 200	100 to 200	100 to 200
Spruce recovery rate with planting (years to pre-epidemic condition)	N/A	30 to 40	30 to 40	30 to 40
Spruce recovery rate without planting (years to commercial age ⁴)	80 to 140	80 to 140	80 to 140	80 to 140
Spruce recovery rate without planting (years to commercial age ⁴)	N/A	70 to 100	70 to 100	70 to 100
Noxious Weeds:				
Soil disturbance (acres)	0	353	243	239

1. Same as that of Alternative 2.
2. Increase would be the same as that of Alternative 1.
3. Full stocking exists when there are 3 to 5 trees per acre.
4. To be considered commercial, average stand diameter would have to be at least 8 to 10 inches in diameter at breast height.

Figure 2-13 Comparison of Alternatives by Issue without Final Interim Rule (cont.)

ISSUE	Alternative 1	Alternative 2	Alternative 3	Alternative 4
ISSUE #5 - VEGETATION RESOURCES (continued)				
Sensitive Plant Species:				
Carrington Daisies (impact determination)	no impact	no impact	no impact	no impact
Arizona Willow (impact determination)	no impact	no impact	no impact	no impact
Musine Groundsel (impact determination)	may impact 5	may impact 5	may impact 5	may impact 5
Maguire Campion (impact determination)	may impact 5	may impact 5	may impact 5	may impact 5
ISSUES #6 - FUEL LOADING AND FIRE RISK				
Fuel reduction (acres harvested)	0	3,200 to 4,200	3,200 to 4,200	2,000 to 2,600
Post-treatment fuel loading (remaining tons/acre in treated areas)	70*	10 to 15	10 to 15	10 to 15
Wildfire potential (risk rating)	high	low	low-mod	moderate
ISSUE #7 - WILDLIFE RESOURCES				
Management Indicator Species:				
Elk and deer - hiding habitat (acres)	12,453	8,852	8,852	10,852
- foraging habitat (acres)	13,619	17,219	17,219	15,959
- vulnerability and use of available habitat (road density)	2.4	1.8	1.8	1.8
Blue Grouse - wintering habitat of Douglas-fir trees affected (acres)	0	0	0	0
Golden Eagle - prey base (availability)	no change	no change	no change	no change
Tree Cavity Dependent Species:				
Snag habitat affected (acres)	0	3,200 to 4,200	3,200 to 4,200	2,000 to 2,600
Threatened and Endangered Species:				
Canada Lynx - Proposed Threatened (effect determination)	no effect	may affect 6	may affect 6	may affect 6
Bald Eagle - Threatened (effect determination)	no effect	may affect 7	may affect 7	may affect 7
Peregrine Falcon - Endangered (effect determination)	no effect	no effect	no effect	no effect
Southwest Willow Flycatcher - Endangered (effect determination)	no effect	no effect	no effect	no effect
Sensitive Species:				
Goshawk (impact determination)	no impact	may impact 8	may impact 8	may impact 8
Flammulated Owl (impact determination)	no impact	may impact 9	may impact 9	may impact 9
Three-toed Woodpecker (impact determination)	no impact	may impact 10	may impact 10	may impact 10
Spotted and Townsend's Big-eared Bat (impact determination)	no impact	may impact 11	may impact 11	may impact 11

- May impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or loss of viability to the population or species. Impact determination based on planned project use of existing South Camel gravel source or ongoing Forest use of stockpiles at North Camel pit.
- May affect individuals or habitat, but is not likely to adversely affect the species or its habitat. Effect determination based on possible disturbance from helicopters during eagle migration.
- May affect individuals or habitat, but is not likely to adversely affect the species or its habitat. Effect determination based on increased human activities, changes to winter habitat, and reforestation.
- May impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or loss of viability to the population or species. Impact determination based on potential indirect effect to prey and activities within nesting habitat.
- May impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or loss of viability to the population or species. Impact determination based on possible avoidance of the area by goshawk.
- May impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or loss of viability to the population or species. Impact determination based on removal of dead trees which represent a food source for woodpecker.
- May impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or loss of viability to the population or species. Impact determination based on use of existing South Camel gravel source which may affect nearby bat roosting.

Figure 2-13 Comparison of Alternatives by Issue without Final Interim Rule (cont.)

ISSUE	Alternative 1	Alternative 2	Alternative 3	Alternative 4
ISSUE #8 - TRANSPORTATION				
Transportation System and Access:				
Forest Development Road construction (miles)	0	1	0	0
Forest Development Road reconstruction (miles)	0	15	15	15
Reclamation of Forest Development Roads ¹² (miles)	0	4	4	4
Reclamation of nonsystem roads (miles)	0	18	18	18
Post-project road and motorized trail access ¹³ (miles)	93	70	70	70
Post-project motorized road/trail density ¹³ (miles per square mile)	2.4	1.8	1.8	1.8
User Safety and Travel Delays:				
Summertime logging traffic (logging vehicles per day)	0	28	27	20
Wintertime logging traffic (logging vehicles per day)	0	0.2	0.2	0.2
Delays in travel from logging traffic and associated road work (extent)	none	minor	minor	minor
ISSUE #9 - RANGE ALLOTMENTS AND IMPROVEMENTS				
Suitable rangeland restricted for timber regeneration (acres)	0	3,566	3,566	2,502
Range improvements affected (number)	0	0	0	0
Duration of grazing restriction for reforestation (years)	0	7 to 20	7 to 20	7 to 20
ISSUE #10 - VISUAL LANDSCAPE				
Post-activity visual quality condition (relationship to visual quality objective)	meets	meets	meets	meets
ISSUE #11 - UNDEVELOPED CHARACTER				
Scenic condition (landscape alteration)	none	negligible	negligible	negligible
Scenic condition (relationship to visual quality objective)	meets	meets	meets	meets
Recreation experience (change to recreation opportunity spectrum)	none	negligible	negligible	negligible
Motorized access network ¹³ (miles of roaded access)	93	70	70	70
Motorized access network ¹³ (roaded access density)	2.4	1.8	1.8	1.8
ISSUE #12 - CULTURAL RESOURCES				
Potential to affect paleontological/cultural resources (treatment acres)	0	6,530	6,530	3,974
Expected prehistoric sites within unsurveyed harvest units (number)	N/A	0 to 4	0 to 4	0 to 4
Effect to prehistoric sites (effect determination)	N/A	no effect	no effect	no effect
Effect to historic sites (effect determination)	N/A	no effect	no effect	no effect
Known sites eligible for National Register of Historic Places (number)	4	4	4	4
ISSUE #13 - ECONOMICS				
Projected employment (number of jobs)	0	346	346	216
Projected employment (created income)	0	\$18,275,000	\$18,275,000	\$11,422,000
Twenty-five percent payments to Counties from project (dollars)	0	\$80,000	\$80,000	\$80,000
Economic efficiency, 1998 present net value (dollars)	-\$74,000	-\$3,777,000	-\$3,753,000	-\$2,485,000
Economic efficiency, 1998 benefit (dollars)	\$0	\$1,238,250	\$1,238,250	\$600,000
Economic efficiency, 1998 cost (dollars)	-\$74,000	-\$5,015,646	-\$4,991,646	-\$3,084,896
Economic efficiency, benefit-cost ratio (benefit/cost)	0	1/25	1/25	1/19
ISSUE #14 - ENERGY				
Fuel consumption (millions of British thermal units)	0	165,193	165,193*	121,824
Fuel output (millions of British thermal units)	0	204,063	204,063	150,490
ISSUE #15 - ROADLESS CHARACTER				
Direct impacts to inventoried roadless (harvest acres in roadless areas)	0	2,542	2,542	0
Direct impacts to inventoried roadless (road construction in roadless areas)	0	1.1	0	0

- Conversion to level 1 maintenance after project use refers to same FDR as proposed for construction.
- Includes Forest Development Roads, nonsystem roads, and motorized trails.

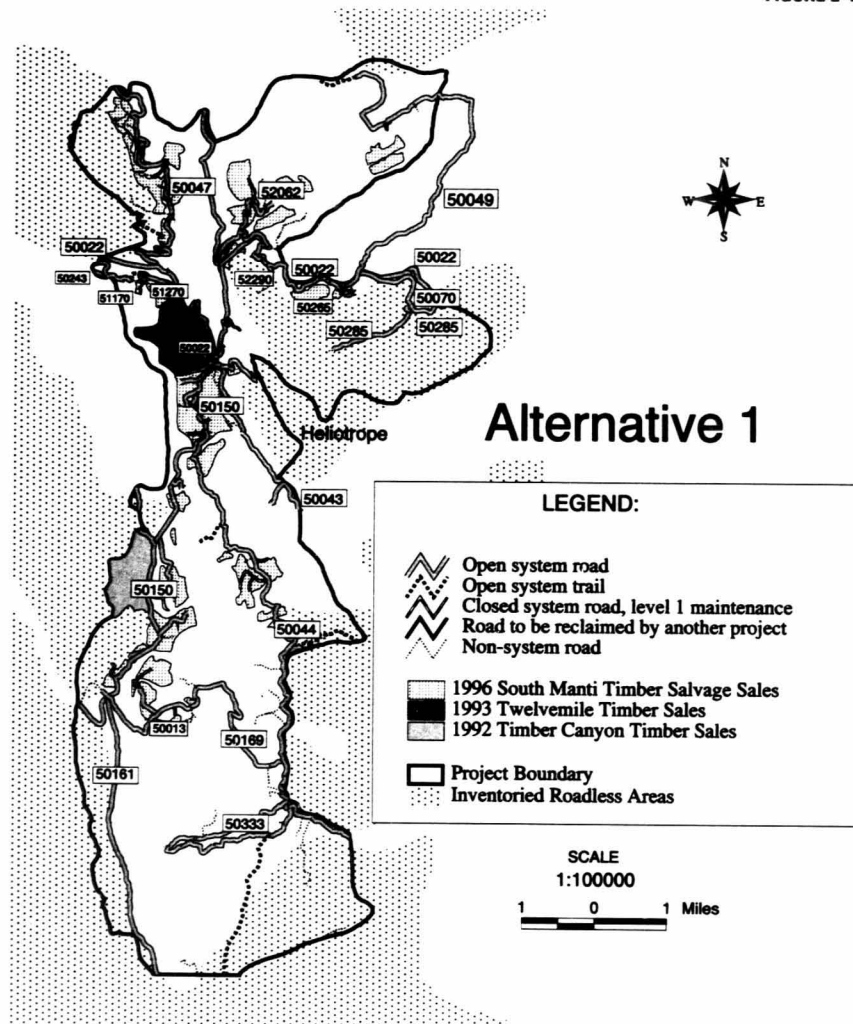
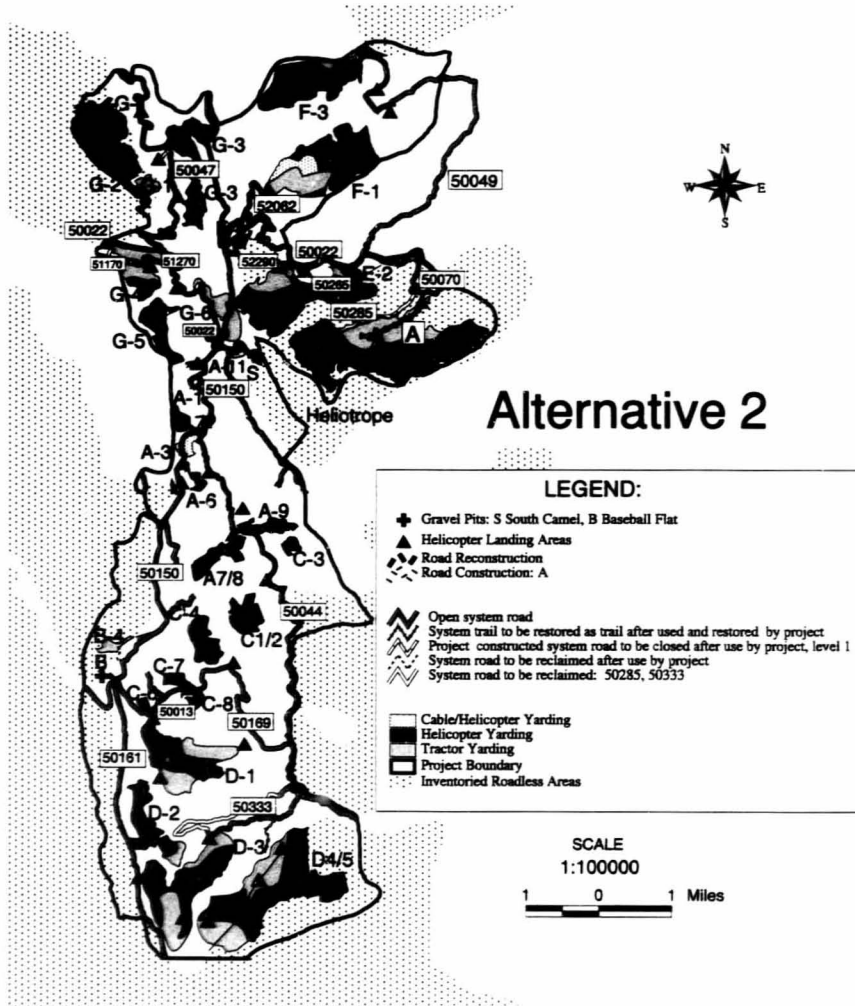
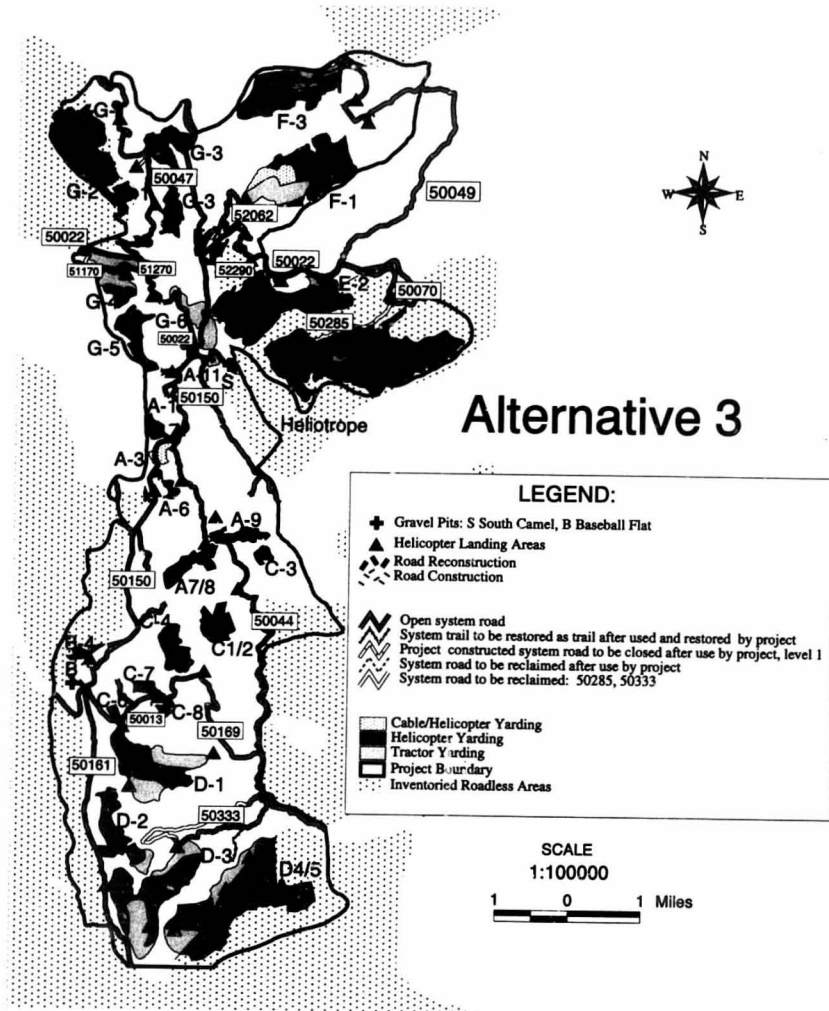


FIGURE 2-2



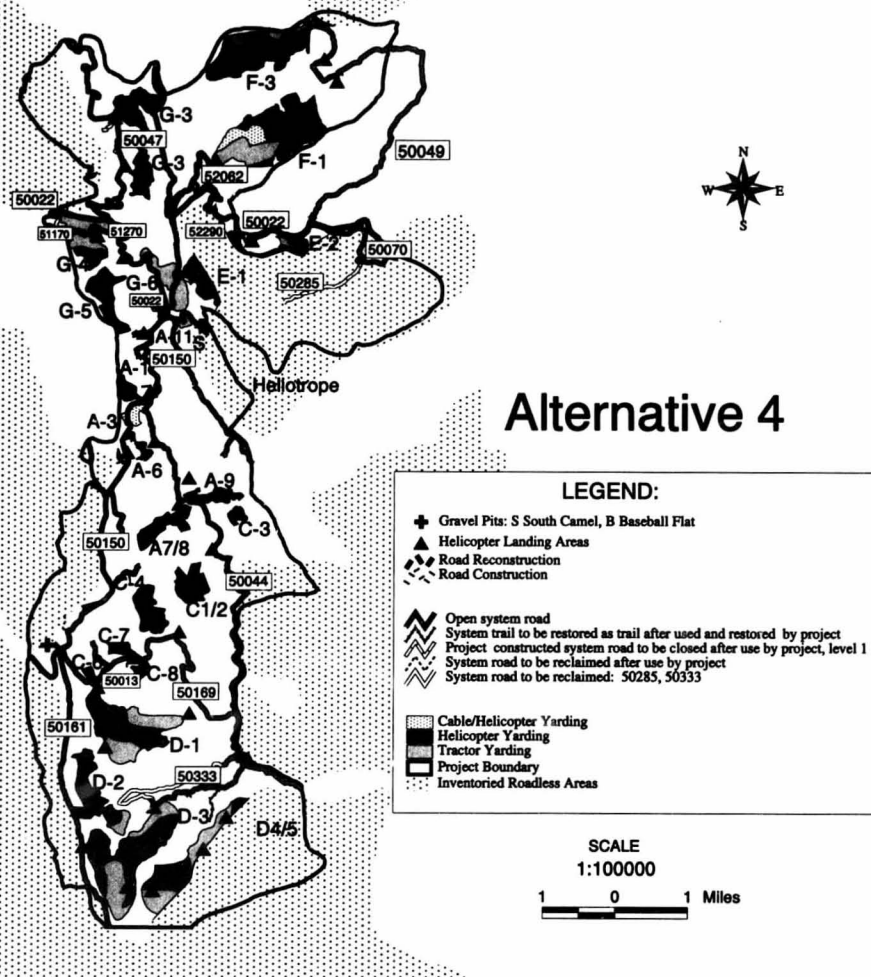
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FIGURE 2-3



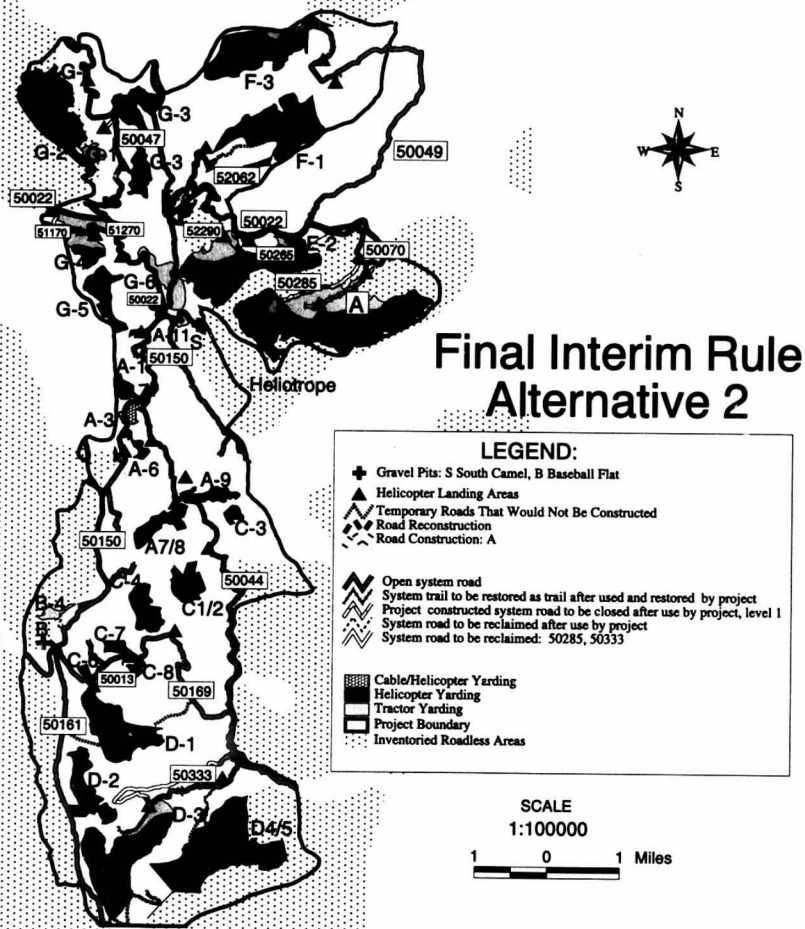
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FIGURE 2-4



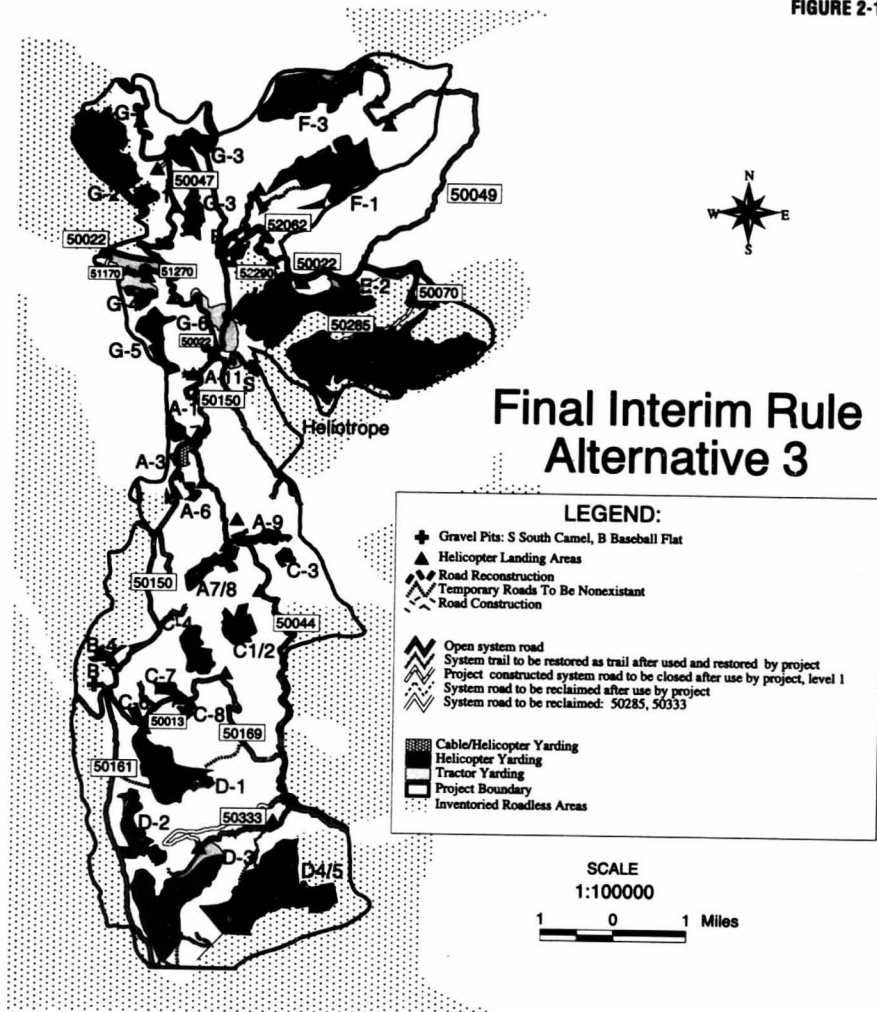
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FIGURE 2-9



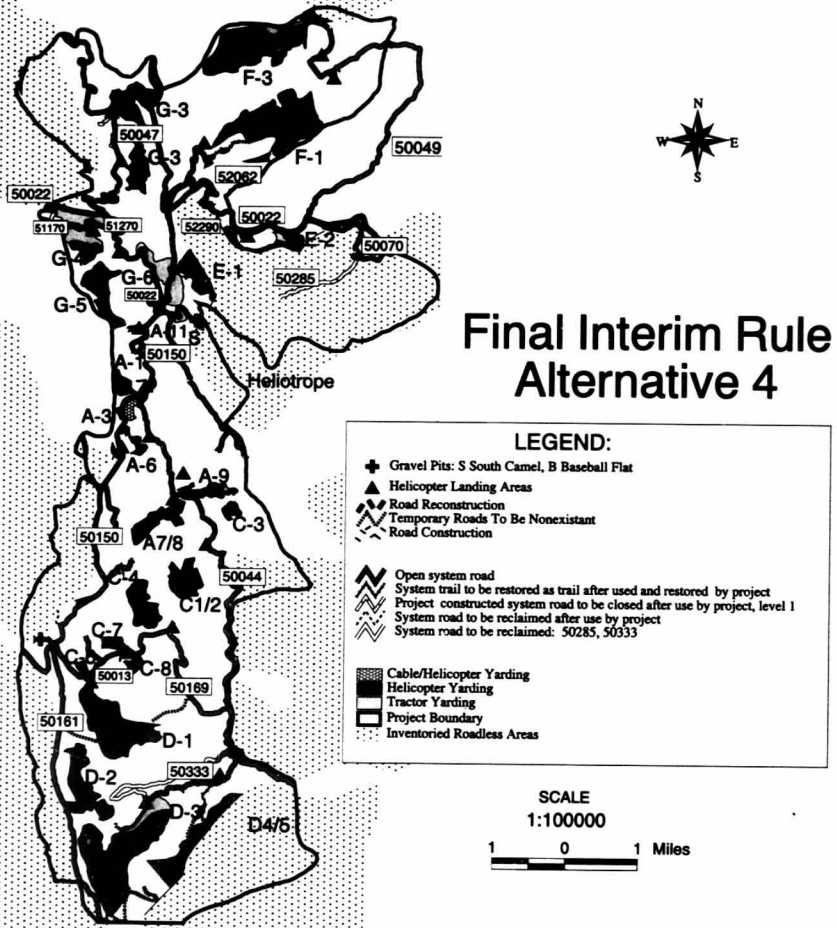
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FIGURE 2-10



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FIGURE 2-11



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CHAPTER 3

AFFECTED ENVIRONMENT

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CHAPTER 3 - AFFECTED ENVIRONMENT

3.0 INTRODUCTION

This chapter describes the existing environmental conditions of the project area that may or may not be affected by the implementation of the alternatives considered in detail, described in Chapter 2. Relevant direction, from the Manti-La Sal National Forest Land and Resources Management Plan, as amended (Forest Plan), and applicable laws/regulations are also discussed in this chapter. For each resource issue, the geographic scope of potential effects is presented followed by a brief description of the existing conditions. Unless otherwise specified, the geographic scope is the project area.

This chapter is divided into the following sections:

- 3.0 Introduction
- 3.1 Setting
- 3.2 Air Quality
- 3.3 Land Stability
- 3.4 Soils
- 3.5 Water Resources
- 3.6 Vegetation Resource
- 3.7 Fuels/Fire
- 3.8 Wildlife Resources
- 3.9 Transportation
- 3.10 Range Allotments And Improvements
- 3.11 Visual Landscape
- 3.12 Undeveloped Character
- 3.13 Cultural Resources
- 3.14 Economics
- 3.15 Energy
- 3.16 Roadless Character

The information presented in this chapter provides a comprehensive frame of reference for the potential effects disclosed in Chapter 4.

Reports and material in the project record, maintained at the Manti-La Sal National Forest Supervisor's Office, was used to develop the following description of the affected environment. The project record contains more information than presented in this chapter.

**Forest Plan
Management Direction**

This project tiers to the direction of the Forest Plan and Record of Decision and incorporates by reference the analysis disclosed in its environmental impact statement.

**Forestwide Goals
and Direction**

The Forestwide direction are presented in the Appendix C - Forest Plan Direction. This direction applies to all areas across the Forest.

**Management Unit
Goals and Direction**

The Forest is divided into fifteen different management units. Six different management units exist within the project area. Figure 3-1 Forest Plan Management Units, describes the different management units within the project area. Figure 3-2 Forest Plan Management Unit Map, shows where the management units are located within the project area.

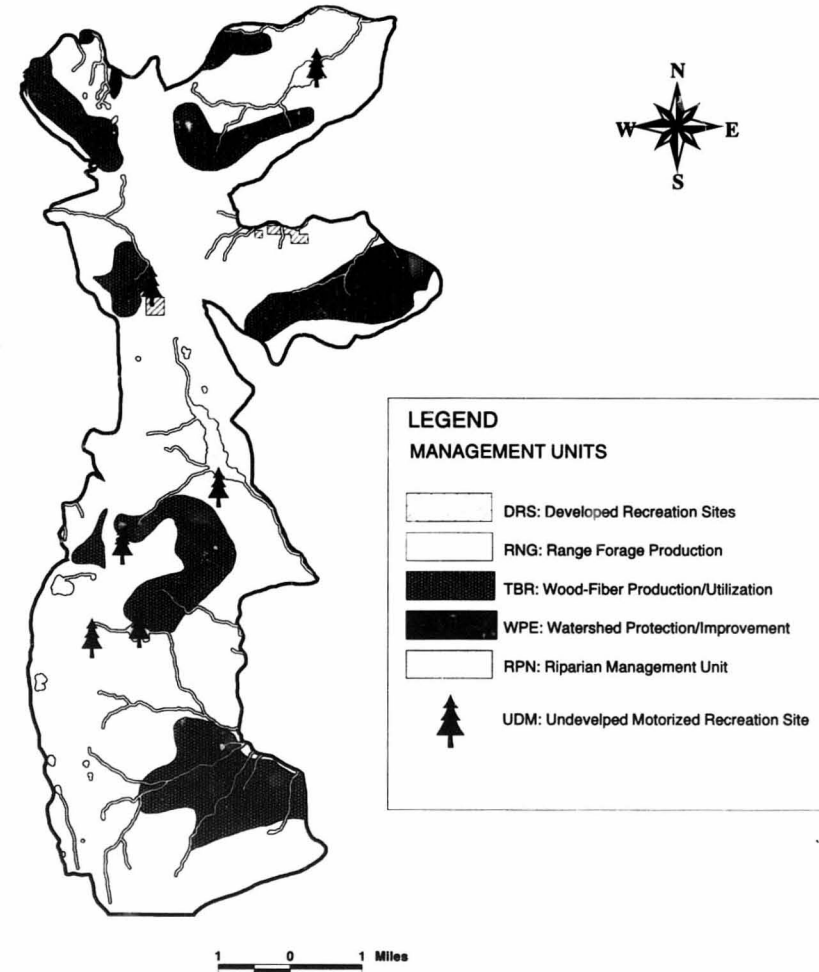
The direction for each management unit supplements and may amend Forestwide direction. The direction applicable to the management units in the project area are presented in Appendix C - Forest Plan Direction.

Figure 3-1 Forest Plan Management Units

FOREST PLAN MANAGEMENT UNIT	Acres	% Project Area
Range Forage Production Management Unit (RNG) Management emphasis is on production of forage and cover for domestic livestock and wildlife. (Forest Plan, p. III-64)	18,924	77%
Wood Fiber Production and Utilization (TBR) Management emphasis is on management for the production and use of wood-fiber for a variety of wood products. (Forest Plan, p. III-67)	5,148	21%
Riparian Management Unit (RPN) Management emphasis is on management of riparian areas, and all the component ecosystems. (Forest Plan, p. III-69)	375	2%
Undeveloped Motorized Recreation Sites (UDM) Management emphasis is on providing high quality dispersed recreation opportunities in areas characteristically receiving moderate to heavy use. (Forest Plan, p. III-52)	6 sites	Included within other mgmt. units
Developed Recreation Sites (DRS) Management emphasis is for developed recreation facilities. (Forest Plan, p. III-47)	97	<1%
Watershed Protection and Improvement (WPE) Management emphasis is for watershed protection and improvement in areas where watershed treatments have been applied, or should be, applied, and where other use restrictions are implemented to protect on-site and downstream values from flooding and sedimentation. (Forest Plan, p. III-77)	52	<1%

FIGURE 3-2

Forest Plan Management Unit Map



3.1 SETTING Geography

The project area is located in Central Utah in the southern portion of the Wasatch Plateau. The Wasatch Plateau is a north-south high plateau bounded by Castle Valley to the east and Sanpete Valley to the west. The project area is approximately 45 miles southwest of Price, Utah, on public lands administered by the Ferron-Price and Sanpete Ranger Districts of the Manti-La Sal National Forest, in Sanpete and Sevier Counties. See Figure 1-1 Vicinity Map, for a geographic presentation of the project's location.

Elevations in the project area range between 8,000 to 11,000 feet above sea level. The topography of the project area varies from rolling plateaus to steeper, east-west drainages and associated canyons. Land features include: dense and open-scattered spruce/fir stands of trees; meadows, brush fields, and open rangeland; limestone, siltstone, and sandstone rock types; glacial cirques, moraines, and till; and streams, reservoirs, and lakes. The basic character of the area has been historically influenced by wildfires, prehistoric humans, domestic grazing, timber harvesting, water impoundment projects, and recreational uses.

Climate

Average annual precipitation is 28 to 35 inches. Precipitation (mainly rainfall) from May through September is 8 to 12 inches. Temperatures in the area range from 13 to 80 degrees Fahrenheit. The freeze-free season ranges from 0 to 40 days, and is usually 0 to 20 days. A neutral to unstable atmosphere predominates with winds usually from the southwest during the day, and local light down-canyon winds at night. Storm systems generally come from the northwest or west, preceded by winds from the southwest to southeast. High intensity thunderstorms are common from mid-July through September.

3.2 AIR QUALITY (Issue #1)

The Forest lies within the Upper Colorado River Air Basin.

Regulatory Framework

The Clean Air Act of 1970, as amended, is the primary legislative tool for improving and maintaining air quality in the United States. The Act also provides for the Prevention of Significant Deterioration of air quality. Correspondingly, areas of the country are classified as Class I, II, or III for Prevention of Significant Deterioration. Figure 3-3 Air Quality Classes, lists the potentially affected areas within a 62-mile (100-kilometer) radius of the project area and their class designation.

Figure 3-3 Air Quality Classes¹

POTENTIALLY AFFECTED AREAS	CLASS ¹	LOCATION TO PROJECT
Capital Reef National Park (northern portion)	I	30 miles south of project area
Manti-La Sal National Forest	II	encompasses project area
Sanpete County	attainment	encompasses project area
Sevier County	attainment	encompasses project area
Utah County	non-attainment	40 miles north of project area

¹ **Class I Areas** - All international and national parks greater than 6,000 acres, and national wilderness areas greater than 5,000 acres which existed as of August 7, 1977. This class provides the most protection to pristine lands by severely limiting the amount of additional human-caused air pollution which can be added to these areas.

Class II Areas - All other areas of the county, unless upgraded to Class I. A greater amount of additional human-caused air pollution may be added to these areas. All Forest Service lands which are not designated as Class I are Class II.

Class III Areas - Areas having the least amount of regulatory protection from additional air pollution. To date, no Class III areas have been designated anywhere in the country.

Attainment Areas - Those areas which meet national air quality standards.

Nonattainment Areas - Those areas which do not meet national air quality standards.

Dispersion and Visibility

States have the primary responsibility for air quality management, which they carry out through implementation plans. A 1988 Memorandum of Understanding between State of Utah Air Conservation Committee and the Forest Service describes the procedures for prescribed fires within National Forests, including the use of a "Clearing Index" (USDA Forest Service, 1992a). The Manti-La Sal National Forest Smoke Management Guidelines for Prescribed Fires contains additional guidance for planning and managing smoke from prescribed fires to achieve air quality requirements through improved smoke management practices (USDA Forest Service, 1992a). Utah also currently has a group developing a Statewide Implementation Plan that will be effective upon completion (Utah Division of Air Quality, 1999). The Forest Plan (p. III-43) requires that all projects meet State and Federal air quality objectives.

High winds are common and dispersion is often very good. However, calm periods do occur which allow smoke or engine emissions to settle nearby and even to drift downslope towards the valleys. Usually winds will blow from the west towards the east, which means that the communities of Ferron and Emery would be downwind. When the winds are from the east, the communities of Mayfield and Sterling would be downwind. All of these communities are more than 10 miles from the project area.

Although within the area of analysis for air quality, Capital Reef National Park and Utah County should not be affected by management activities within the project area. Potential pollutants should not affect Capital Reef National Park because it is not normally downwind of the project area. Potential pollutants should not reach Utah County because winds do not prevail from the south (usually from the southwest) and the distance to Utah County would usually allow for adequate dispersal.

Industrial activity adjacent to the Forest is generally located downwind and usually does not affect air quality on the Forest. Industrial activity in the area is light or dispersed and the resulting air quality in the area is generally good to excellent. Air quality monitoring has not been extensive in the area, but most reports show levels within National Ambient Air Quality Standards.

Visibility depends on the amount of materials suspended in the air (particulates). The project area has some of the best air quality, regarding particulates and least light extinction, in the United States (USDA Forest Service, 1992a). Visibility within the project area ranges from 40 miles to 120 miles throughout much of the year, surpassing the average visibility in rural areas of the Southwestern United States of 65 miles to 80 miles. Exceptions are usually caused by dust during windstorms.

The National Ambient Air Quality Standard for coarse particulate dispersion less than or equal to a size of 10 micrometers in aerodynamic diameter (PM-10), for a maximum 24-hour period is: 150 ug/m³ (micrograms per cubic meter). The National Ambient Air Quality Standard for fine particulate dispersion less than or equal to a size of 2.5 micrometers in aerodynamic diameter (PM-2.5) for a maximum 24-hour period is 65 ug/m³. Measurements of particulates have not been made in the project area. However, measurements of surrounding cities were taken in 1974. The maximum 24-hour average PM-10 particulates measured for Price and Castle Dale were 181 ug/m³ and 86 ug/m³, respectively. PM-2.5 particulates often reflect 90 percent of PM-10. Applying this assumption, the maximum 24-hour average PM-2.5 particulates measured for Price and Castle Dale in 1974 could have been 163 ug/m³ and 77 ug/m³, respectively. Particulate levels have likely exceeded National standards in local areas within the project area as a result of dust displaced by high winds.

Health

Particulates, SO_x (airborne compounds of sulfur oxides), NO_x (airborne compounds of nitrogen oxides), HC (airborne hydrogen chloride), and CO (carbon monoxide gas) can affect health. Carbon and Emery Counties have high levels of emissions in some of these categories while Sanpete and Sevier Counties have relatively low emissions. Particulates are predominantly caused by dust from roads (greater than 90 percent average for all four counties). Monitoring of sulfur dioxide, oxidant, and nitrogen oxides in the area has shown levels to be well below National Ambient Air Quality Standards. No monitoring has been done in the project area for carbon monoxide or hydrocarbons, but the rural nature of the region and the generally good dispersion characteristics suggest acceptable levels of these compounds.

3.3 LAND STABILITY
(Issue #2)

The geologic structure of the area is well understood. East of the divide, the rock units dip generally about 4 to 6 degrees to the west. West of the divide, the rock units dip sharply westward, as much as 20 degrees, forming a steep single-limbed fold known as the Wasatch Monocline. North-south trending faults are common within the monocline.

Rocks exposed in the area range from the mid-Cretaceous period (90 million years ago) to the Paleocene period (70 million years ago). From oldest to youngest, the geology consists of the North Horn Formation, Flagstaff Limestone, and surface deposits consisting of glacial till, colluvium, alluvium, and landslide debris. These features are described in Figure 3-4 Geology.

Figure 3-4 Geology

GEOLOGY	DESCRIPTION
North Horn Formation	The North Horn Formation consists of imbedded shale, sandstone, conglomerate, and limestone. Shale members contain a high percentage of clay with a low resistance to erosion and a low shear strength when wet which causes unstable slopes.
Flagstaff Limestone	The Flagstaff Limestone is relatively competent, cliff-forming, and caps the major high ridges and peaks. It consists of limestone with minor amounts of shale and sandstone. Rock falls and rock slumps are common on steep cliff faces undercut by erosion and landslides in the underlying less resistant North Horn Formation. Failure planes are commonly formed along shale partings.
Surface Material	Surface materials (glacial till, colluvium, alluvium, and landslide debris) derived from the Flagstaff Limestone and North Horn Formation drape the slopes at depths to 170 feet. Landslide deposits as thick as 350 feet have been measured at the Manti Canyon North Slide. Soil creep is evident along steep slopes, especially north-facing slopes that tend to have thicker soil deposits.

The project area contains numerous landslides; including rock slides, rock falls, rock slumps, debris flows, earth flows, and complex landslides that contain more than one type of movement. These features have been common since the last glacial period.

Isolated high-frequency, low-magnitude landslides have occurred within the project area and in other areas of similar geology. Such events typically occur during average or below average precipitation years or cycles. They are typically caused by earthquakes or localized changes in geologic conditions (topography, drainage patterns, ground moisture, slope support mechanisms) due to natural processes or man's activities. They are considered to be high-frequency because they are not restricted to low-frequency, high precipitation cycles. Examples of such landslides in the same or similar geology include: the 1969 Slide Lake landslide within the project area; the 1971 Boulger Canyon landslide near the project area; and the 1975 Cottonwood and Manti North landslides away from the project area.

A portion of these landslides have been triggered by human activities such as road building and water pipeline development where there has been a disruption of natural drainage and/or inefficient drainage. It is likely that historically humans caused changes in vegetation, topography, and water flow which contributed to conditions that ultimately resulted in isolated landslides. Earthquakes are also thought to be triggering mechanisms for landslide activity on the Manti Division of the Forest. In the project area however, there are no obvious spatial correlations between recent land management disturbances such as roads, campgrounds, or reservoirs, and the occurrence of high-frequency, low-magnitude landslides.

Most landslides mapped within the project area appear to be predominately the result of geologic conditions and natural triggering mechanisms such as earthquakes, extreme precipitation cycles, and erosion. Late snowstorms, rapid snowmelt, and high runoff volumes in 1983 and 1984 caused flooding, severe erosion, and saturation of surface materials. Approximately 427 new landslides were mapped on the Wasatch Plateau from these conditions. A greater number of landslides correspondingly occurred on the west side of Skyline Drive (Forest Development Road #50150) within the North Horn Formation. These were low-frequency, high-magnitude landslide events. The recurrence interval for the two-year precipitation received through June of 1983 is about 125 years along the west side of the Wasatch Plateau.

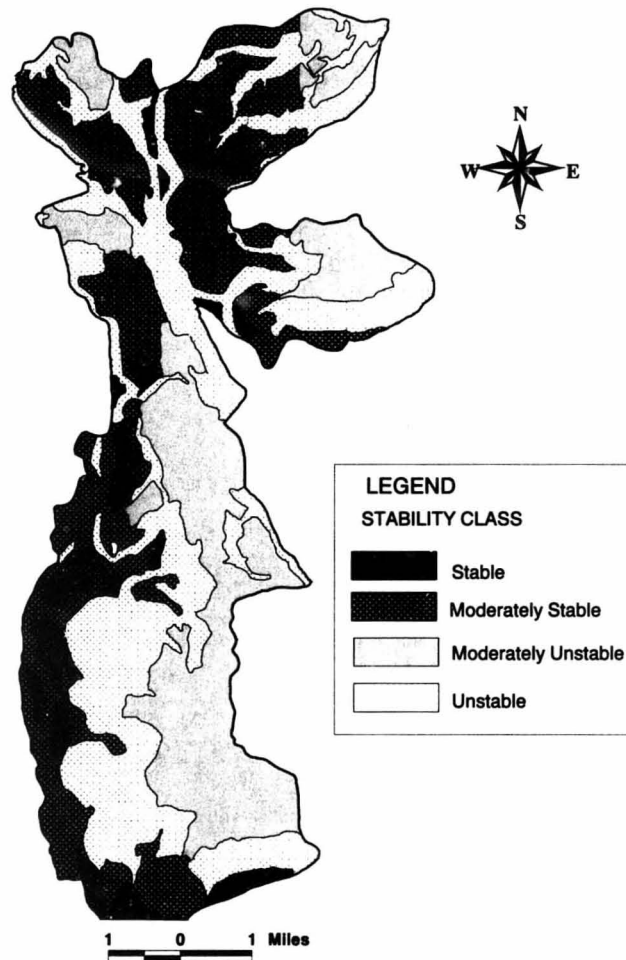
A land stability map was produced for the project area using Godfrey's 1978 and 1985 work as a base with refinement for more recent and detailed information. Paleo and recent landslides were mapped from aerial photography. Land stability zones were delineated based on landslide occurrences, geologic information, and topographic information. Four stability zones were delineated as a result of this effort (see Figure 3-5 Land Stability Classes, and Figure 3-6 Land Stability Class Map)

Figure 3-5 Land Stability Classes

STABILITY CLASS	Acres	% Area	DESCRIPTION
Unstable	8,825	37%	Areas actively sliding or moving, exhibiting a high occurrence of landslides (recent and ancient), and areas of similar geologic and topographic characteristics. These areas have a high potential for new landslides to occur and existing landslides to become active, with or without human activity. The defining characteristics include: (1) North Horn Formation outcrops and overlying surface deposits with slopes greater than 35 percent; (2) Flagstaff Limestone outcrops and overlying surface deposits with slopes ranging from 35-60 percent that are near to and could be undercut by erosion of the North Horn Formation; and (3) Flagstaff Limestone cliffs with slopes exceeding 60 percent.
Moderately Unstable	6,799	27%	Areas containing fewer landslides (recent and ancient) than the unstable area, and areas with similar geologic and topographic characteristics. These areas have potential for new or reactivated landslides with human activity and during average and above precipitation years or cycles. These areas often contain the toes or runout zones of landslides that occurred on steeper slopes above. The defining characteristic is North Horn Formation outcrops and overlying surface deposits with slopes ranging from 20-35 percent.
Moderately Stable	7,350	30%	Areas containing few landslides and exposed formations with slopes generally below the threshold associated with landslide. This area can contain the runout zones of landslides that originated in the more unstable zones on steeper slopes. Small slumps and local sloughing may occur due to saturated conditions, erosion, and intensive human activity. Defining characteristics include: (1) North Horn Formation outcrops with slopes less than 20 percent; (2) Flagstaff Limestone outcrops on slopes that range from 35-60 percent where not undercut by erosion and landslides in the North Horn Formation; and (3) Flagstaff Limestone outcrops on slopes ranging from 10-35 percent.
Stable	1,613	6%	Flat-lying areas in stable formations (Flagstaff Limestone). No stability problems are anticipated in these areas. Defining characteristics include: (1) Flagstaff Limestone outcrops on slopes less than 10 percent, and (2) alluvial deposits on slopes less than 10 percent.

FIGURE 3-6

Land Stability Class Map



3.4 SOILS (Issue #3)

The soils in the project area were mapped using aerial photography transferred to paper maps. The geographic scope for analysis of the soil resource (compaction, erosion, and productivity) is the project area itself. Off-site impacts of soil movement are discussed in the land stability and water resources sections.

Nearly all of the soils in the project area are derived from the Flagstaff Limestone Formation and shale and limestone of the North Horn Formation. These are usually residual materials over bedrock on the plateau tops, colluvial materials on the mountain slopes, and glacial till and landslide materials in the basins. In general, the soils have dark colored topsoil layers of about 6 to 18 inches in thickness. Soil textures are typically clay loam or clay, with varying amounts of rock fragments. The soils derived from limestone materials are generally cobbly or stony, while those from shaley material have lower amounts of rock fragment. Soil reaction is typically pH 6.0 to 7.8. Subsoils typically have a light color from the influence of limestone. A dense, subsoil material is often encountered in the soils developed on glacial till.

Soil Map Unit Descriptions

The soil descriptions used in this analysis are from in the Draft Soil Resource Inventory of the Manti Division (USDA Forest Service, unpublished).

Most soils have a moderate to moderately-high susceptibility to compaction rating. Compaction susceptibility is generally greatest on sites with slopes of less than 40 percent. Most soils have a moderate soil erodibility rating, however the potential for erosion to occur is largely dependent upon the steepness of the slope and the amount of surface cover. Most of the area has a low-moderate erosion hazard rating. Figure 3-7 Soil Erosion Potential, describes the soil map units within the project area and presents their erodibility and erosion hazard ratings.

Soil Productivity

The long-term productivity and sustainability of forests and rangelands depends on maintaining the quality of soil properties and conditions that affect the productivity and hydrologic function for soils. Guidelines have been set, beyond which it is reasonably certain that there will be long-term losses in productivity or hydrologic function (USDA Forest Service, 1993a). Under current conditions, none of the areas proposed for treatment exceed the soil quality guidelines. Current erosion rates are well within soil loss tolerance thresholds. Ground cover and above ground organic matter are at or above optimum levels for the various soil types.

Figure 3-7 Soil Erosion Potential ¹.

SOIL MAP UNIT	Acres	% Area	Slope%	Soil Erodibility	Erosion Hazard
1 Moderately deep, well-drained, medium textured soils on limestone tablelands at high elevations. Vegetation: grass-forb type.	47	<1%	0 to 20	M	L
2 Moderately deep and deep, medium to fine textured soils on rolling mountain slopes on shale and limestone at high elevations. Vegetation: grass-forb type.	23	<1%	10 to 40	M to H	M
3 Rock outcrops	14	<1%		L	L
4 High mountain benches with medium fine textured soils on limestone and shale. Vegetation: mosaic spruce-fir and grass-forb openings.	419	4%	5 to 30	M	M
8 Steep, generally south facing mountain slopes on limestone and shale. Soils range from deep fine textured soils to shallow cobbly soils. Vegetation: mountain brush, grass-forb, scattered aspen and conifers.	110	1%	30 to 80	M	H
45 Steep, south facing mountain slopes with moderately deep and deep medium to fine textured soils. Vegetation: grass-forb, elderberry, and aspen.	34	<1%	30 to 60	M to H	H
46 Steep, rocky ridges and glacial headlands at high elevations. Soils shallow to deep and very stony. Vegetation: spruce-fir type.	1,522	15%	30 to 80	L to M	M
414 Glacial basins and benches at high elevations. Geologic materials include glacial till and some landslide material, with inclusions of residual limestone. The soils are medium to fine textured, and are often cobbly. Vegetation: spruce-fir and aspen types with grass-forb and mountain brush openings.	2,502	25%	5 to 25	M	L to M
415 Rough, rocky basins and benches at high elevations. Soils very stony, bouldery, and cobbly. Vegetation: spruce-fir type.	2,201	22%	5 to 40	L	L
600 Benches and depositional mountain slope lands from glacial and landslide material of limestone and shale origin. Soils are deep and have fine to moderately fine textures. They are very cobbly to nearly stone free. Small ponds and wet spots are common in this unit. Vegetation: spruce-fir and aspen types.	1,681	16%	5 to 40	M	M
602 Moderately steep basin slope lands and benches mostly on old landslide materials. Soils are deep and have medium to fine textures. Vegetation: sagebrush, grass-forb, and aspen types.	5	<1%	0 to 40	M	M
700 Steeply sloping, high elevation, north facing mountain slopes on limestone. Soils generally deep with moderately fine textures and a high cobble or stone content. Vegetation: spruce-fir type.	1,652	16%	130 to 75	M	M

¹ **Soil Erodibility** - The soil erodibility rating (K) is a relative measure of the susceptibility of soil particle to detachment and transport by rainfall and runoff. K values that have been obtained experimentally range from 0.02 to 0.69. A rating of "low" equals less than 0.20, "moderate" equals 0.20 to 0.40, and "high" equals greater than 0.40. "L" = low. "M" = moderate. "H" = high. **Erosion Hazard** - Erosion hazard is a relative measure of erosion potential of bare ground. The rating does not include cover from vegetation, organic matter, or rock fragments in the soil. Actual soil erosion rates would be substantially lower when vegetative cover is present. A rating of "low" equals less than 5 tons/acre (0.03 inch) sediment, "moderate" equals 5 to 50 tons/acre (.03 to 0.3 inch) sediment, and "high" equals greater than 50 tons/acre (0.3 inch) sediment. "L" = low. "M" = moderate. "H" = high.

3.5 WATER RESOURCES (Issued #4)

The project area is within the Colorado River and Sevier River Basins. The Colorado River basin includes Muddy and Ferron watersheds. Muddy Creek is tributary to the Dirty Devil River, which flows into the Colorado River at Lake Powell. Ferron Creek is tributary to the San Rafael River which joins the Colorado River above Lake Powell. The Sevier River Basin includes Sixmile and Twelvemile watersheds, both of which flow to the San Pitch River which flows into the Sevier River. Portions of the project area drain into Salina Creek and then into the Sevier River. The Sevier River is a closed basin located entirely within the State of Utah.

For analysis purposes, the drainage basins have been divided into 4 watersheds: Muddy Creek, Twelvemile, Sixmile, and Ferron Creek. These watersheds have been further divided into 35 subwatersheds.

Seventeen lakes, reservoirs, and ponds, representing about twenty-two percent of the lakes within the Forest boundary, occur within the project area: Sixmile Ponds, Deep Lake, WPA Ponds, Island Lake, Duck Fork Reservoir, Rush Ponds, Ferron Reservoir, Willow Lake, Julius Flat, Blue Lake, Henningson Reservoir, Slide Lake, Emerald Lake, Spinners Reservoir, Oleys Lakes, Emery Reservoir, and Three Lakes. These waters are important to irrigation, recreation and fisheries.

WATER QUANTITY Water Yield

Water quantity is often expressed in terms of water yield. Water yield is the amount of water that flows from an area and appears in the streams (expressed in acre-inches). The water yield from the project area provides an important water supply for Sevier, Sanpete, and Emery Counties. The project area has some of the highest water yield rates on the Wasatch Plateau. These yields are related to the higher precipitation at high elevations. The mean annual water yield from the area is reported as 8 to 18 inches.

Near the ridges there are few streams, even though there is high precipitation, because the underlying rock is limestone. Most of the precipitation water and snowmelt infiltrates and percolates through this layer and then reappears as springs near the contact between the limestone and the underlying sandstone and shales.

Timing of Flow

Snowpack remains until late May or June due to the average low temperatures and high elevations. Peak flow in streams occurs in early to mid-June when snowmelt runoff contributes the majority of annual stream flow. Low stream flows occur during the winter, usually in February. Summer thunderstorms can cause flash flooding in the small canyons, although they generally do not produce enough volume to be a large contributor to the annual flow in the larger drainages.

Spruce trees that have been killed by beetles no longer transpire water (pull water from the ground into the plant and release it into the atmosphere). More water remains in the ground since the transpiration that moves water up from the rooting zone is reduced. Therefore, less water is needed to recharge the soil moisture, and higher flood flows and water yields are more likely than in the past.

WATER QUALITY

Water quality standards for the streams of Utah are legislated by the State (Utah Division of Water Quality, 1994). These standards are tied to the beneficial uses that are made of the water. For each stream reach in the State of Utah, the beneficial uses have been identified. All waters within the project area are designated as high quality waters. The State water quality standards for the waters within and downstream from the project are presented in Figure 3-8 Water Quality Standards.

Figure 3-8 Water Quality Standards ¹.

Streams And Stream Reaches	Standards ¹ .
Ferron Creek and tributaries from Millsite Reservoir to the headwaters	1C, 2B, 3C, 4
Muddy Creek and tributaries from Highway U-10 crossing to the headwaters	2B, 3A, 4
Twelvemile Creek and tributaries from Forest boundary to the headwaters	2B, 3A, 4
Sixmile Creek and tributaries	2B, 3A, 4
Salina Creek	2B, 3B, 4

- ¹. 1C = Waters protected for domestic purposes with prior treatment by standard complete treatment processes as required by the Utah Department of Health.
2B = Waters protected for recreation uses including boating and water skiing, but not swimming.
3A = Waters protected for cold water fisheries.
3B = Waters protected for warm water fisheries.
3C = Waters protected for non-game fish and other aquatic life.
4 = Waters for irrigation

The State of Utah requires that Best Management Practices (BMPs) be used on National Forest System lands. The Forest Service is the designated water quality management agency for National Forest System lands and is responsible for implementing BMPs on such lands. BMPs are usually derived from Forest Service Handbook 2509.22 So'l and Water Conservation Practices (USDA Forest Service, 1988).

The Forest Plan requires that water quality be maintained or improved and that BMPs are used in all resource activities. The waters on the National Forest are to meet State Water Quality Standards.

Water quality parameters used in this analysis are chemical components and sediment from surface erosion.

Chemical Components Samples collected show water is generally of high quality and well within State standards.

Sediment Standards that relate to sediment prescribe a limited increase in turbidity above the natural background levels. The background level of total suspended solids, which can be related to turbidity, have been measured ranging from 0 to 26,000 parts per million.

Detached soil and rock particles are termed sediment while being transported in the water and when deposited. Total sediment production includes input from mass movements, channel erosion, and surface erosion.

Mass movements usually occur sporadically, moving large amounts of material into stream channels and altering the course of streams. This analysis did not directly measure or predict sediment volumes from historic or current mass movements.

Channel erosion is a common feature in many of the streams within the project area. There have been some hydrologic events, such as the floods of 1983 and 1984, that have caused severe channel adjustments. These flood events in combination with the landslide activity during the same time period, especially west of Skyline Drive (Forest Development Road #50150), have caused stream channels to move out of equilibrium. Many stream reaches have over-steepened banks, bank erosion, and constant channel adjustment which causes in-channel erosion, a major source of sediment.

Sediment yields from surface erosion have been estimated for each subwatershed using a model called SEDROUTE. The landscape was divided into relatively similar units called land types and/or soil resource mapping units. Erosion coefficients were estimated

and erosion products routed to the streams to be counted as sediment were estimated. The modeled results provide an estimate of background sediment yield levels of 64 tons/mile square to 976 tons/mile square depending upon the drainage. These estimates only address sediment from overland flow and do not consider sediment from mass movements or in-stream channel erosion.

RIPARIAN, WETLAND, AND FLOODPLAINS

Riparian areas, wetlands, and floodplains are inherently interconnected and overlapping. Riparian areas are associated with perennial surface water present all year except for severe drought. Wetlands are associated with surface or ground water that is present often, and long enough, so that conditions characteristic of wetlands are reflected in the species of vegetation and the character of the soils. Floodplains are areas that are inundated by floods. The floodplains of concern are those areas that would be flooded by 100-year to 500-year recurrence events.

Riparian

Riparian management (RPN) units are defined in the Forest Plan as extending 100 feet horizontally on either side of the high water line of all perennial water. RPN units are associated with perennial streams, lakes, and reservoirs.

Perennial and intermittent stream channels within the project area, specifically those with an abundance of spruce mortality, contain great amounts of large woody debris. Field estimates of large woody debris (greater than 12 inches diameter) range from 250 to 400 pieces per stream mile (Davies Field Review, 1998). Mortality of spruce within spruce-fir riparian zones is high. As these dead trees fall into stream channels over the next 5 to 30 years, large woody debris is expected to double reaching 500 to 800 pieces per stream mile.

The dominant vegetation community has been inventoried in some RPN units. RPN units that contain conifer timber types have the potential of being impacted by salvage harvest. RPN units that do not contain conifer timber types would not be impacted by harvest activities, except for possible impact at road crossings. The average width of inventoried riparian areas within potential treatment areas is 28 feet, including the width of the stream. Approximately 33 percent of all riparian length is in conifer timber types.

Approximately 40 acres (less than 1 percent) of RPN units are associated with the 17 previously mentioned lakes, reservoirs, and ponds.

Wetlands

Wetlands are managed under the guidance of Executive Order 11990 (1977) and Forest Service Manual 2527 (USDA Forest Service, 1994c). Wetlands regulations are enforced by the Army Corps of Engineers and the Environmental Protection Agency. Generally when a human-caused alteration to streams or wetlands is proposed, a 404 Permit is needed to assure wetlands and aquatic resources are protected. A nationwide permit is in place concerning wetlands less than 0.1 acre in size. There is a general exemption for silvicultural activities that applies if certain conditions are met. The Forest Plan (p. III-71) requires 404 Permits to be acquired as needed.

Wetlands contain wetland vegetation, hydric soils, and are wet at least 15 days each year during the growing season. Using vegetation as the sole criteria for defining wetlands over estimates the amount of wetlands. From an aerial photograph review, potential wetlands were identified using vegetation as the sole criteria within the project area. Most wetlands are small, generally less than 10 acres - often much smaller. The wetlands are not continuous across the landscape, but may be linear in places for as much as half a mile. In some instances, wetlands are associated with constructed reservoirs. Wetlands also occur in association with beaver dams and along stream channels.

Floodplains

Floodplains are regulated by Executive Order 11988 (1977) and Forest Service Manual 2527 (USDA Forest Service, 1994c). Forest Service Manual 2527 states that the 100-year and 500-year floodplains, for critical actions, will be avoided so far as practical. No facility will be developed within the 100-year flood plain unless it is a functionally dependant use, such as a culvert or a bridge. Where no practical option is available, the facility is labeled a functionally dependent use of the floodplain and necessary mitigating measures are to be incorporated.

AQUATIC HABITAT AND SPECIES Stream and River Fisheries

The following perennial streams within the project area support fish populations: South Fork of Muddy Creek (including Black Fork, Mill Fork, Fish Creek, Slide Fork, Reservoir, and two unnamed tributaries), North Fork of Muddy Creek (including unnamed tributaries), Muddy Creek (mainstem), South Fork Twelve Mile Creek (and unnamed tributaries), Twelve Mile Creek (mainstem), South Fork of Six Mile Creek (including the tributaries that enter the South Fork of Six Mile Creek upstream from Six Mile Ponds), Ferron Creek, Mill Stream, Little Horse Creek, Singleton Creek, Indian Creek, Lake Fork, Georges Fork, and Duck Fork Creek.

Species that could be directly or indirectly affected within the project area are: Yellowstone cutthroat (*Oncorhynchus clarki*), rainbow trout (*Salmo gairdneri*), red shiners (*Notropis lutrensis*), fathead minnows (*Pimephales promelas*), speckled dace (*Rhinichthys osculus*), reidside shiners (*Richardsonius balteatus*), flannel-mouth suckers (*Catostomus latipinnis*), roundtail chubs (*Gila robusta*) and mountain suckers (*Catostomus platyrhynchus*) (Berg, 1999).

There are several high-value recreational stream fisheries within the project area. Duck Fork Creek (above the reservoir), Lake Fork, and Indian Creek support naturally-reproducing Yellowstone cutthroat populations. Angler information from the Muddy and Twelve Mile drainages indicates that both streams support small naturally-reproducing populations of Yellowstone cutthroat trout.

Two non-game species, flannel-mouth suckers and roundtail chubs, are known to inhabit mainstem reaches below the project area and are currently classified as "Species of Concern" by the State of Utah.

Reservoir and Lake Fisheries

Several reservoirs and lakes could be directly or indirectly affected by activities within the project area: Slide Lake, Three Lakes, Blue Lake, Julius Flat Reservoir, Island Lake, Emerald Lake, Emery Reservoir, Spinners Reservoir, Shingle Mill Reservoir, Deep Lake, WPA Ponds, Oleys Lake, Rush Pond, Willow Lake, Ferron Reservoir, Duck Fork Reservoir, and Six Mile Ponds.

Twelve of these reservoirs and lakes are intensively managed as "put-and-take" fisheries by the Utah Division of Wildlife Resources (i.e. stocked fisheries with very high angler catch rates). Blue Lake and Emery Reservoir are stocked with brook trout. Willow Lake is stocked with tiger trout (*Salvelinus fontinalis* x *Salmo trutta*), a sterile hybrid between brook trout (*Salvelinus fontinalis*) and brown trout (*Salmo trutta*) (Berg, 1997). Blue Lake was stocked with grayling (trout) in 1997 (Berg, 1997). Julius Flat, Island Lake, Emerald Lake, Spinners Reservoir, Deep Lake, and Ferron Reservoir are all stocked with rainbow trout. Ferron and Duck Fork Reservoirs are stocked heavily with cutthroat trout and are heavily used by anglers. Duck Fork reservoir is currently managed as quality fishery by the Utah Division of Wildlife Resources (i.e. there are restrictions on slot size limit, required use of artificial lures only).

Amphibians

Field inspections of pot-hole habitats in the 1995 field season (Dufour, 1995) found Great Basin Spadefoot toad (*Scaphiopus intermontanus*) larvae and egg clusters in pot-hole habitats in the Upper Muddy drainage (approximately 10,000 feet in elevation above sea level). No other information is known about amphibian distribution, although suitable habitats exist throughout the project area.

Status of Aquatic Habitats

Muddy and Twelve Mile Creeks are unique drainages within the Forest in that they support fish but have very low road densities. Lack of easy access has probably protected trout populations from high angler mortality. The stream channels appear to be recovering from historic livestock grazing impacts (Burns, 1995). Stream inventories conducted by Forest Biologists in 1981 noted re-establishment of cottonwoods and willows in riparian areas, unstable banks in places, and silt deposition in pools. Extensive soil movement and channel adjustment was observed by the Forest Fisheries Biologist in response to high runoff in the Upper Muddy drainage in 1995 (Dufour, 1995). High fall flows caused substantial channel down cutting and some lateral adjustment in the lower portion of the same drainage near the Forest boundary (Dufour, 1995).

Basin-wide inventories of aquatic habitat conditions in the Upper Ferron drainage were conducted in 1995. Three streams were inventoried: Little Horse Creek, Duck Fork Creek, and Lake Fork Creek. Data from these field surveys show that habitats for all salmonid life history stages, including spawning and rearing, are present. Some areas of these channels continue to show evidence of 1983 and 1984 flood events (i.e. signs of channel adjustment and bank-cutting were evident). A study of the role of large woody material in these three streams demonstrated that wood directly creates pool habitat. In Duck Fork Creek, woody debris created 43 percent of the pool habitat. In Little Horse Creek, woody debris created 51 percent of the pool habitat. In Lake Fork Creek, woody debris created 38 percent of the pool habitat. Wood is therefore a significant contributor to the pool habitat component that provides fish with foraging, resting, hiding, and over-wintering habitats in otherwise high-current environments.

Abundant wetlands have been observed throughout the project area. Wetlands are critical to aquatic communities in that they act as water reserves and provide base flows during low water periods. Potholes, small ponds, and marshy areas provide subsurface flow that supplements direct water sources like springs and run-off. These wet areas support invertebrate and amphibian populations.

Aquatic macroinvertebrates are management indicator species, identified in the Forest Plan, to assess impacts of management activities on aquatic communities and water quality. Monitoring stations are located at the Forest boundary on Ferron, Muddy, and Twelve Mile Creeks. Water quality in Twelve Mile Creek appears to have improved steadily since the landslide and flooding events of 1983 and 1984. Data results for Ferron Creek and Muddy Creek are so variable that there is no apparent trend.

Threatened, Endangered, and Sensitive Aquatic Species

There are no known threatened, endangered, or Forest Service Region 4 sensitive fish species within the project area. However, small populations of native Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*) may still inhabit isolated headwater stream reaches throughout the project area although none have been currently documented. A population of Colorado River cutthroat trout is planned to be introduced into Little Horse Creek sometime in 1999, or later, by the Utah Division of Wildlife Resources (Berg, 1997).

Far downstream from the project area, there are four Colorado River fish species which are currently listed as endangered: Colorado squawfish (*Ptychocheilus lucius*), bonytail chub (*Gila robusta*), humpback chub (*Gila cypha*), and razorback sucker (*Xyrauchen texanus*).

There are no threatened or endangered amphibian species within the project area.

Habitat suitable for supporting the spotted frog (*Rana pretiosa*), the only Forest Service Region 4 sensitive aquatic amphibian species on the Forest, is not present in the project area (Perkins, 1995; Keleher, 1995). Herpetological staff with the Utah Division of Wildlife Resources indicate that spotted frogs prefer lower elevation sites, usually in floodplains or near springs. The project area is at a much higher elevation than where frogs have been observed.

3.6 VEGETATION RESOURCE (Issue #5)

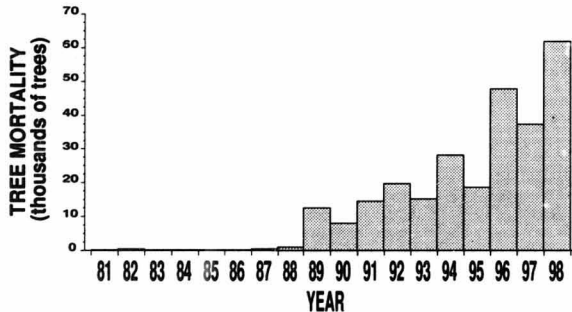
FOREST HEALTH, DIVERSITY, AND PRODUCTIVITY

Forest Health

The 1996 South Manti Timber Salvage Sales Environmental Assessment disclosed the potential effects of proactively implementing sanitation treatments in areas that were not infested by spruce beetle when that project was started (USDA Forest Service, 1996c). Disclosed effects also included information relative to expansion of the beetle infestation into these areas. This scenario has since occurred as critical time frames necessary to proactively sanitize the stands have lapsed due to administrative and political constraints. Therefore, the following information from the 1996 South Manti Timber Salvage Sales Environmental Assessment combined with other pertinent information provides a the current condition of forest health and diversity of the area.

Since 1989, extensive Engelmann spruce mortality has occurred on the Ferron/Price and Sanpete Ranger Districts as the result of epidemic populations of spruce beetle (*Dendroctonus rufipennis*) (see Figure 3-9 Annual Spruce Beetle-Caused Tree Mortality). Spruce beetle infestation and subsequent spruce tree mortality levels have clearly exceeded endemic (natural, balanced) levels.

Figure 3-9 Annual Spruce Beetle-Caused Tree Mortality
(Munson, 1998)



In 1993, the project area was identified to include the Engelmann spruce-subalpine fir forest type on the Ferron/Price and Sanpete Ranger Districts that were infested or in imminent danger of infestation from a spreading spruce beetle epidemic. Uninfested and lightly infested spruce-subalpine fir stands in the area, in imminent danger of infestation, were also included in the project area. Areas in imminent danger of infestation were located near Lake Fork and Blue Meadows. Approximately 10,211 acres of Engelmann spruce-subalpine were identified as potential sites for silvicultural treatments as a result of the spruce beetle epidemic, which was killing most of the spruce trees equal to and greater than eight inches in diameter at breast height.

Prior to making a decision on the 1996 South Manti Timber Salvage Sales Environmental Assessment, the spruce beetle population had expanded from two centers near Black Mountain and Skyline Drive (Forest Development Road #50150). The infestation extended from the joint boundary of the Fishlake National Forest and Manti-La Sal National Forest, at the southern end of the project area, north to Twelvemile Creek. Previously uninfested areas that were originally identified as being in imminent danger of infestation are now infested at epidemic population levels.

The spruce tree mortality and infestation currently extends from the southern Forest boundary north along the Wasatch Plateau to Potters Canyon (see Figure 3-10 Project Spruce Beetle Infestation Map, and Figure 3-11 Landscape Spruce Beetle Infestation Map). A Forest Service Entomologist estimates that 30,000 acres of spruce-fir forest have been affected by the spruce beetle infestation to date across the Forest (Anhold, 1998).

Forest Service Forest Health Protection personnel surveyed portions of the infested area in 1993 (USDA Forest Service, FPM, 1993). Survey results indicated that 52 percent of the spruce in infested stands was dead. Results also indicated a corresponding reduction in the average spruce live-tree diameter at breast height from 19.9 to 15.3 inches (Munson, 1994).

Additional surveys completed by Forest Service Forest Health Protection personnel in 1996 and 1998 further indicate a substantial amount of beetle-induced spruce mortality within and adjacent to the project area (see Figure 3-12 Beetle-Induced Spruce Mortality) (USDA Forest Service, FPM, 1996 and 1998). The spruce beetle prefers large diameter trees, but normally will attack trees as small as six to eight inches, especially when populations are at epidemic levels. In 1998 sampled stands, approximately 73 percent of the spruce trees equal to or greater than 5 inches in diameter at breast height have died as a result of the epidemic (see Figure 3-12 Beetle-Induced Spruce Mortality). Also in 1998 sampled stands, 91 percent of the spruce trees greater than 11 inches in diameter at breast height have died as a result of the epidemic. This mortality has correspondingly changed the condition of the remaining stand of trees (see Figure 3-12 Beetle-Induced Spruce Mortality).

FIGURE 3-10

Project Spruce Beetle Infestation Map

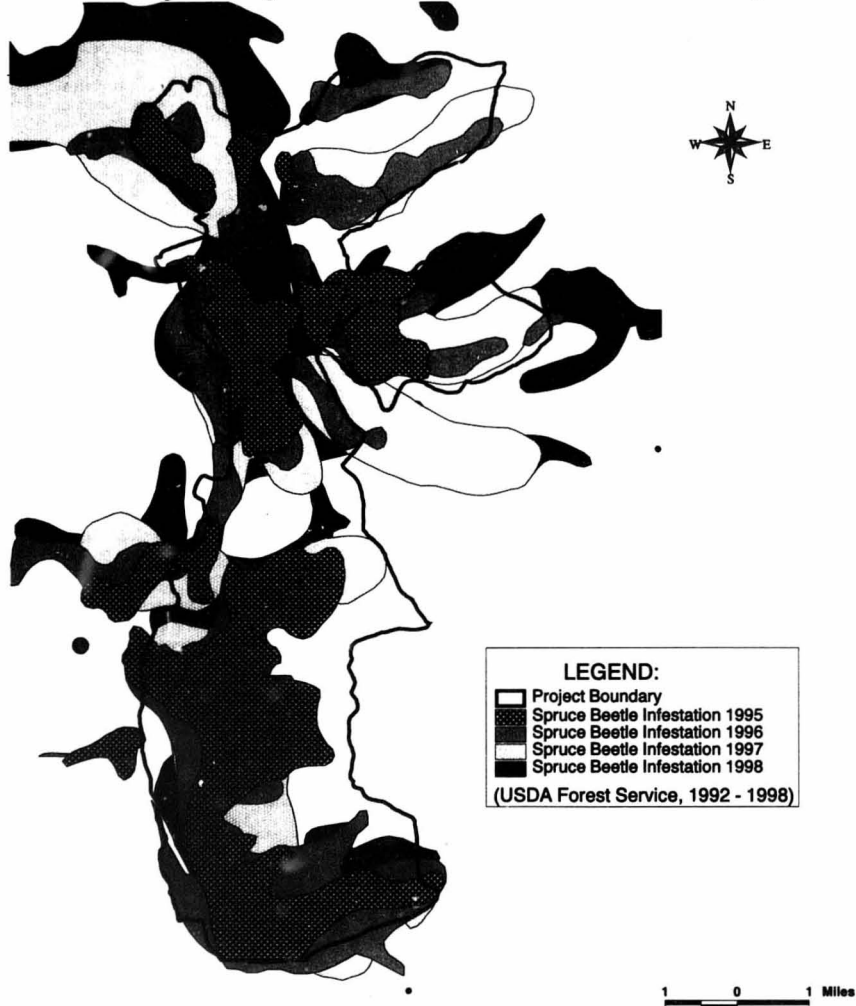


FIGURE 3-11

Landscape Spruce Beetle Infestation Map

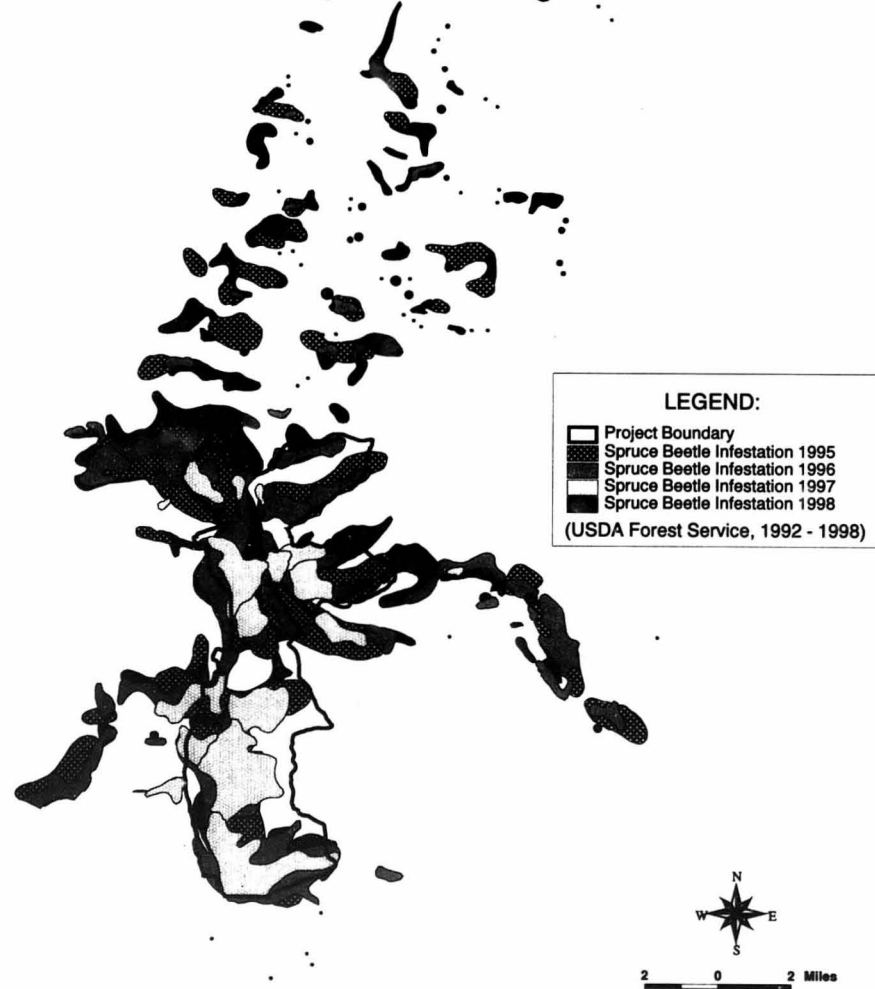


Figure 3-12 Beetle-Induced Spruce Mortality
(Anhold and Munson, 1998)

SPRUCE ≥ 5" AVG. DIAMETER AT BREAST HEIGHT		SURVEY YEAR 1996	SURVEY YEAR 1998
AVERAGE LIVE TREE DIAMETER ¹	Pre-Outbreak At Time of Survey	14.0" 9.3"	14.3" 8.6"
NUMBER OF LIVE TREES PER ACRE (tpa)	Pre-Outbreak At Time of Survey	97 tpa 41 tpa	89 tpa 23 tpa
LIVE BASAL AREA (sq. ft.)	Pre-Outbreak At Time of Survey	100 sq.ft. 20 sq.ft.	93 sq.ft. 9 sq.ft.
PERCENT TREES PER ACRE OF MORTALITY		58%	74%
PERCENT BASAL AREA MORTALITY		80%	90%

SPRUCE >11" AVG. DIAMETER AT BREAST HEIGHT		SURVEY YEAR 1996	SURVEY YEAR 1998
AVERAGE LIVE TREE DIAMETER ¹	Pre-Outbreak At Time of Survey	17.2" 14.8"	17.4" 13.5"
NUMBER OF LIVE TREES PER ACRE (tpa)	Pre-Outbreak At Time of Survey	54 tpa 10 tpa	49 tpa 4 tpa
LIVE BASAL AREA (sq. ft.)	Pre-Outbreak At Time of Survey	88 sq.ft. 12 sq.ft.	81 sq.ft. 4 sq.ft.
PERCENT TREES PER ACRE OF MORTALITY		81%	92%
PERCENT BASAL AREA MORTALITY		86%	95%

¹ Pre-outbreak average diameter may differ between 1996 and 1998 because sample plot locations varied between the two surveys.

Approximately 535 acres of dead spruce trees have been salvaged under the 1992 Timber Canyon and 1993 Twelvemile Timber Sales. A total of 2,045 acres have been, or are being treated, under the 1996 South Manti Timber Salvage Sales. Within the areas proposed for treatment under this current planning effort, 6,258 acres were included in the 1996 South Manti Timber Salvage Sales Environmental Assessment and 272 acres are newly identified. Figure 3-10 Project Area Spruce Beetle Infestation Map, and Figure 3-11 Landscape Spruce Beetle Infestation Map, shows the areas currently infested by spruce beetle. These infested areas represent all of the spruce stands within the project area.

Forest Diversity

A wide variety of plant communities and plant species occur within the project area: conifer timber types, aspen types, riparian types, high mountain grass and forblands, and high mountain brushlands. Conifer timber types occur mostly on the north and east aspects, slopes, and upper basins. Aspen types are mostly found on the upper bench lands, mixed with the conifer on lower north slopes and on the higher south slopes, and in the mid-elevation basins. Riparian types are generally found along the small streams, wet meadows, around small natural lakes and springs. High mountain grass and forblands are found mostly on the plateau tops, upper bench lands, and exposed slopes and ridge tops. High mountain brushlands occur on the high plateau tops, exposed south slopes, and ridges.

The dominant habitat types of the timber stands being considered for treatment are classified as Subalpine fir/Mountain gooseberry (*Abies lasiocarpa/Ribes montigenum*) and Subalpine fir/Oregon grape (*Abies lasiocarpa/Berberis repens*). Stands vary from uniform tree spacing to clumpy, open conditions. The stands are generally uneven-age

and mature with Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*) dominant in the overstory. Quaking aspen (*Populus tremuloides*) and limber pine (*Pinus flexilis*) also occur in some stands. The understory is generally subalpine fir and Engelmann spruce. The less tolerant aspen and limber pine are generally being replaced by the more tolerant spruce and fir species, except in those locations where events have occurred which disrupt spruce-fir encroachment. Undergrowth shrub species include mountain gooseberry, mountain snowberry, and red elderberry. Herbaceous species include sweetroot, heartleaf amica, European yarrow, and rose sedge.

Based on a 1960 timber survey, the project area includes five primary forest cover types: 1) Engelmann spruce-subalpine fir 11,490 acres; 2) Douglas-fir 105 acres; 3) Aspen 2,857 acres; 4) Grass and brush lands 8,762 acres; and 5) Barren lands/rock 856 acres. An additional 527 acres was not classified at the time of survey. These primary forest cover types are presented in Figure 3-13 Forest Cover Type Map.

Approximately 10,817 acres of the spruce-subalpine fir cover type area were identified as spruce sawtimber. These sites are characterized by dominant spruce overstory trees that are equal to and greater than nine inches in diameter breast height.

The spruce beetle epidemic has created a vegetation condition that is less varied, and more open in structure than conditions existing prior to the outbreak. In areas of essentially pure, large-diameter spruce trees, mortality has reached 100 percent. These high mortality levels result in the loss of the larger (greater than 8 inches in diameter) live spruce trees from the stands. The effects of this mortality are: 1) Reduced average stand height and diameter; 2) Conversion of the species composition from a dominant or moderate spruce mix towards subalpine fir; 3) Destruction of seed source in some areas, slowing natural regeneration and recovery of those sites to a forested condition; and 4) Increased fuel loading and fire hazard if an ignition were to occur.

Data from the 1996 South Manti Timber Salvage Sales Environmental Assessment indicates that before the beetle infestation, spruce trees comprised about half of the overall stand structure (USDA Forest Service, 1996c). The percentage of spruce has declined rapidly as the infestation and associated mortality continued. Subalpine fir, and to a minor extent quaking aspen and limber pine, have replaced the more commercially valuable spruce as the only dominant or larger residual live trees in many areas. Figure 3-14 Changes in Forest Type and Stand Structure, summarizes the changes in forest or community type and stand structures that has resulted from the beetle infestation.

Figure 3-14 Changes in Forest Type and Stand Structure

FOREST TYPE	1996	1998
Spruce-Fir Forest Type	10,124 acres	756 acres
Engelmann Spruce Forest Type	87 acres	20 acres
Subalpine Fir Forest Type	0 acres	9,435 acres

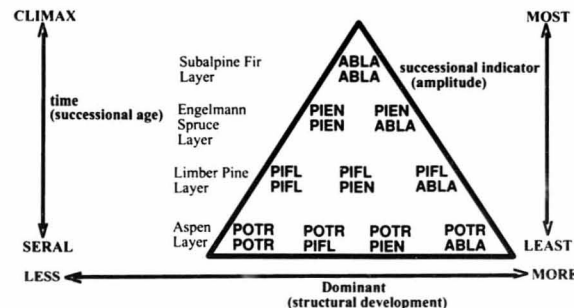
STAND STRUCTURE	1996	1998
Open Stand Condition - Low Stocking	988 acres	6,285 acres
Single Story Structure - Even-Aged Condition	164 acres	384 acres
Multi-Storyed Structure - Uneven-Aged Condition	9,059 acres	3,542 acres



1 0 1 Miles

Engelmann spruce, and the more intolerant quaking aspen and limber pine, have shifted toward minor roles in the structure of the ecosystem in relation to subalpine fir. Some natural expansion of limber pine will occur through natural seeding in disturbed areas with suitable seed trees, and aspen will expand where competing spruce have died within and on the fringes of existing aspen clones, allowing suckering (sprouting) of the existing root system. Successional characteristics are dependent on individual site conditions (e.g. soils, elevation, moisture), existing plant species, and level of disturbance. Not all sites are capable of supporting limber pine or quaking aspen following major disturbance events. In sites unsuitable for quaking aspen or limber pine, early tree succession would be limited to the upper layers of the diagram.

Figure 3-15 Succession Possibilities 1.



1. Adapted from a process developed by Steele and Geier-Hayes, 1986.

ABLA = Subalpine Fir (*Abies lasiocarpa*)
PIEN = Engelmann Spruce (*Picea engelmannii*)
PIFL = Limber Pine (*Pinus flexilis*)
POTR = Quaking Aspen (*Populus tremuloides*)

Forest Productivity

The Forest Plan defines suitable timber stands using the following criteria: 1) Able to produce 20 cubic feet or more per acre per year; 2) Capable of being restocked within 5 years; or 3) Can be harvested within direction of the Forest Plan (USDA Forest Service, 1986). Sites meeting these criteria are determined to be suitable for commercial harvest for timber or wood fiber production. All of the forested areas considered for potential silvicultural treatments are suitable for timber harvest, based on average stand productivity figures. Some areas within these stands, totaling approximately 2,311 acres have been estimated as nonstockable or unsuitable based on soil suitability and ground conditions that preclude regeneration within five year restocking requirements. Unsuitability does not preclude salvage harvest of dead and dying trees.

Stands were mature prior to infestation by the spruce beetle. The average stand age is approximately 140 years, with individual trees up to 250 years in age. For the proposed treatment areas, average trees per acre and merchantable volumes per acre of live and dead trees greater than 5 inches in diameter at breast height are displayed in Figure 3-16 Stand Characteristics of Treatment Areas Proposed for Treatment.

Figure 3-16 Stand Characteristics of Treatment Areas ¹.

	Avg. Trees per Acre		Avg. Volume per Acre (MMBF) ²	
	1996	1998	1996	1998
Dead Spruce	38	64	6.4	10.8
Live Spruce	50	24	8.4	4.0
Total Spruce	88	88	14.8	14.8
Other Species	96	96	2.6	2.6
TOTAL	184	184	17.4	17.4

¹ Adapted from 1996/1998 treatment area data, trees greater than 5" diameter breast height.
² MMBF = thousand board feet.

In 1996, approximately 386,250 dead and dying spruce trees with a total dead and dying volume of 65 million board feet (MMBF) existed within treatment areas.

In 1996, an additional 507,000 live spruce trees with a total volume of 71 MMBF were in imminent danger of attack from spruce beetle within treatment areas. These trees in imminent dangers included trees uninfested at the time of inventory in infested stands and spruce in stands which at that time had not been affected by the advancing epidemic. Most of these previously identified trees in imminent danger have since died during subsequent beetle flights.

Within the area currently affected by the epidemic, spruce in all forest types have been or are being attacked by spruce beetle. Current spruce mortality exceeds 73 percent of the spruce trees within the area (more than 653,000 trees), with approximately 110 MMBF of dead and dying spruce (see Figure 3-12 Beetle-Induced Spruce Mortality).

Stand Development

Stand development or stand production is directly affected by how well stocked a stand is, or how well the potential growing space in a stand is occupied. Long and Smith (1984) published a paper which provides a descriptive model of stand development which can be used for understanding stand conditions and development within the project area.

Prior to the spruce beetle outbreak, stand conditions were comparable to Stage C and D of the stand development model. Full site occupancy occurs in Stage C, and density-related mortality begins to occur as a stand enters Stage D. Prior to the outbreak, growth rates and tree health of stands in the project area were declining, and density-related mortality was occurring in some areas of the stands. This assessment is based on visual signs of older tree mortality, tree decay, root decline, and tree density found in some sites. Site occupancy can normally be quickly regained at this stage. Mortality is at a level that as openings are created, the sites are quickly occupied by the expanding crowns and root systems of residual trees.

Stand inventory data indicates that as individual stands were infested and extensive mortality began to occur, they moved into a condition comparable to Stage E of the stand development model. This stage is characterized by high mortality and decreasing growth. As mortality occurs, large gaps are created, and the site or stand cannot be fully occupied until regeneration occurs (natural or artificial). Stand production is substantially

below the sites potential to produce. The ability of the stands to recover to pre-infestation conditions has been severely limited by the loss of the larger diameter spruce trees. Currently, few dominant or codominant spruce 15 inches in diameter at breast height or larger are left in many areas to provide a viable seed source for natural regeneration of spruce (Alexander, 1987). Although spruce and subalpine fir can begin producing cones at heights of 4 to 5 feet in height, sapling, pole, and small sawtimber size trees are generally poor seed producers.

Increases in herbaceous material in affected stands following the epidemic also limit natural regeneration and seedling growth (Schmid and Hinds, 1974). Increased levels of light, nutrients, and moisture available to understory shrub, forb, and grass vegetation will substantially increase growth of these herbaceous species, reducing and inhibiting tree seedling establishment and subsequent seedling distribution within these stands.

In 1996 it was estimated that approximately 2,066 acres (20 percent of the treatment areas) of spruce-subalpine fir forest stands were not fully occupied (stocked) with any species or size of live trees as a result of this epidemic (1996). Of this area, 1,749 acres were estimated to require artificial planting or treatments to promote natural regeneration to return these sites to normal stocking standards in a short to moderate time frame. It was also estimated that 2,459 acres may require reforestation efforts if mortality projections associated with the 1996 South Manti Timber Salvage Sales Environmental Assessment 'No Action' or 'Proposed Action' alternatives were reached. These mortality projections have since occurred. A total of 6,285 acres of forest stands were, or were not considered to be fully occupied (stocked) as a result of the epidemic. Approximately 227 acres of the 2,459 acres requiring reforestation treatments following salvage harvest under the South Manti Timber Salvage Sales Environmental Assessment decision were planted in 1998, and 566 acres have been planted in the Twelvemile and Timber Canyon timber sale areas in 1997 and 1998. A total of 793 acres have been reforested following salvage harvest within these earlier treatments.

NOXIOUS WEEDS

A noxious weed is defined as a plant that is extremely prolific, invasive, competitive, harmful, destructive, and difficult to control. It is also a plant that has been designated by legislative action for control. Based on the annual Forest noxious weed report, about 16,000 acres of the Forest are infested with noxious weeds.

Musk thistle (*Carduus nutans*), White top (*Cardaria draba*), and Canada thistle (*Cirsium arvense*) are the three noxious weeds known to occur within the project area. Known musk thistle locations include sites near Spinners Reservoir, Ferron Reservoir, the head of Sixmile Canyon, Millfork Canyon, and Twelvemile Canyon. White top sites can be found west of Julius Flat Reservoir, Twelvemile Canyon, and the head of Sixmile Canyon. Canada thistle infestations are usually associated with wetland/riparian areas. It is likely other areas within the project area are infested. All of these weedy plants have the potential to grow in a wide variety of habitats and can spread rapidly into disturbed sites.

THREATENED, ENDANGERED, AND SENSITIVE PLANT SPECIES

About 500 to 600 plant species occur within the project area. Of these, one is listed as a threatened plant species, Heliotrope milkvetch (*Astragalus montii*). Information regarding this species and potential effects is contained in Appendix J - Biological Assessment. There are no endangered plant species within the project area. There are no plant species proposed for listing within the project area.

Four plant species within the project area are listed as Forest Service Region 4 sensitive: Carrington daisies (*Erigeron carringtonae*), Arizona willow (*Salix arizonica*), Maguire campion (*Silene petersonii*), and Musine groundsel (*Senecio musiniensis*).

Carrington daisies have been found in small isolated populations mostly on Flagstaff Limestone Formation outcrops at the head of Cove Creek, on top of East Mountain, at the south rim of Heliotrope Mountain, and on top of Ferron Mountain. This plant is associated with a low forb vegetation type.

Arizona willow can be found within a perennial wet meadow at the head of the Muddy Creek drainage. The plant typically grows two to three feet tall.

Scattered populations of Maguire campion have been found mostly on Flagstaff Limestone Formation outcrops on high elevation ridges and snowdrift sites from Wagon Road Ridge south to the top of White Mountain. There is also a small population of Maguire campion on Mount Baldy and Black Mountain. This plant is part of the sub-alpine low forb plant community.

Musineae groundsel can be found on open tops on Flagstaff Limestone Formation barriers, such as Heliotrope Mountain, and possibly on Mount Baldy and White Mountain.

REGULATORY FRAMEWORK

Under the Endangered Species Act, it is Forest Service policy to analyze potential impacts to threatened and endangered species (refer to Appendix J - Biological Evaluation). Although not required under the Endangered Species Act, it is also Forest Service policy to analyze potential impacts to species proposed by the Fish and Wildlife Service for listing as threatened or endangered and sensitive species (USDA Forest Service, 1995b). Sensitive species are those identified by the Forest Service Regional Forester as, "those species for which population viability is a concern, as evidenced by significant current or predicted downward trends in population numbers or density" or "significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution," (USDA Forest Service, 1995b).

3.7 FUELS/FIRE (Issue #6)

FIRE HISTORY

The Manti division of the Manti-La Sal National Forest encompasses about 800,000 acres of which approximately 65,000 acres consists of private lands inside the Forest boundary. Fire occurrence on the Manti Division averages about 20 fires per year. Of those 20 fires, 3 (15 percent) are person-caused and 17 (85 percent) are ignited by lightning. There has been an average of one ignition per year over the past 27 years within the project area. Typically, due to direct suppression and/or wet conditions, these fires rarely reach more than one acre in size (the largest fire in the past 27 years in the project area is 1 acre). There is no indication that ground fires have burned through this area for several decades.

Historically, severe fire activity in spruce-fir stands resulted in stand replacement. Evidence of this is exhibited by the lack of climax condition stands. During low fire severity periods (wet conditions), fire did not carry well through the existing fuels and the spruce-fir stands were generally not directly impacted by fire. No substantial fires have occurred in this area in the last 75 to 100 years. There is some indication of small fires that appear to have burned themselves out (less than 0.25 acre in size).

Grazing in the area has reduced some of the fine fuels under the timber stands. The reduced amount of fine fuels may have kept ground fires from spreading. However, the fine ground fuels at these high elevations often do not cure sufficiently to carry a ground fire during the summer months. The first hard frost in the late fall usually begins the curing process. Perennial grasses and forbs cure out before the fall in extreme drought years, which occur approximately 10 to 15 percent of the time.

FIRE SUSCEPTIBILITY

There are four basic factors important to forest susceptibility to wildfire and the results of fire impacts: fire susceptibility of the different species, stand structure, existing fuel loading, and fuel moisture.

Bradley (1992) provides a thorough discussion of how fire affects tree species found within the project area. In general, the relative resistance of a tree species to fire, from highest resistant to lowest resistant, is: limber pine, Engelmann spruce, subalpine fir, and aspen. For example, if a stand consists of aspen and subalpine fir, there will be a high mortality rate to these trees even with a low to moderate fire intensity.

Stand Structure

The three primary Fire Groups represented within the project area are: the Dry Lower Subalpine Habitat Types (Group 10); the Moist to Wet Subalpine Habitat Type (Group 11); and the Colder, Upper Subalpine Habitat Types (Group 12).

Comparing the successional trend pathways for Fire Groups 10, 11, and 12 to the existing vegetative conditions in the project area, the spruce/subalpine fir overstory (70 percent or more) is past mid-successional levels for these fire groups. Forests with a strong component of aspen in the overstory (50 percent or more) coupled with invading subalpine-fir is indicative of stands quickly approaching the mid-successional level. The forested acres with heavy spruce tree mortality will be converted back to the early mid-successional stages for these Fire Groups.

The development of more multi-layered canopies creates a high vertical continuity of fuels. This vertical continuity of fuels creates a potentially high risk of spread from crown fires. This high crown fire risk is a key element to the potential for stand-replacement wildfires. Stands within the project area that are dominated by mature spruce and subalpine fir have significant amounts of fine fuels in the lateral twigs, which when dead, curl against the larger branches or trunk, frequently along the entire length of the tree. Dead trees are often closely intermingled with live vegetation and easily spread fire to the overstory crowns during dry weather. The increased threat of crown fire remains until the dead needles and/or the fine branches fall from the tree.

Fuel Moisture

Fuel moisture in the spruce/fir type is typically higher than either the mixed-conifer or pine type. This higher fuel moisture is the primary reason for the very long stand replacing fire frequencies in the project area.

The canopy closure of the mature forest (prior to the beetle infestation and presently until the dead trees lose their needles) resulted in the retention of moisture and humidity during normal precipitation years. This higher fuel moisture content results in a lower risk to fire starts. However, in dry years when fuel moisture is low, fire starts will occur, though less frequently than in mixed-conifer or pine types.

In areas of heavy spruce mortality, there will be accelerated loss of canopy closure thereby creating openings in the stand. However, the fuel moisture levels in these openings will be higher due to less transpiration from dead trees, thereby making more soil moisture available for perennial grasses, forbs, and shrubs.

Dead and Down Fuel Loads

Present fuel loading within the project area is quite variable, with as much as 70 tons per acre of down fuel. The average down fuel loading is about 30 tons per acre. It is estimated that pre-epidemic fuel loading would be 10 to 15 tons per acre of down fuel. The average size of the existing ground fuels is generally greater than 3 inches in diameter. This size of material, also referred to as 1,000 hour time lag fuels, usually results in a relatively low rate of spread for ground fires, but with an overall high fireline intensity rating. In some cases, the intensity rating can be greater than 400 BTU's/Second/Foot. Because of the predominantly cold, moist conditions in subalpine forests, even those stands having relatively heavy fuel loads may not experience fires for many decades.

Figure 3-17 Fuel Loading and Fire Potential, reflects fuel data collected in 1995 and estimated fire potential for 1995 and 2020 if nothing is done to remove or treat fuels. The 2020 estimated fire potential is based on the following association to 1995 fuel loadings: a low rating would exist for 1995 fuel loadings of 0 to 10 tons per acre, a medium rating would exist for 1995 fuel loadings of 20 to 29 tons per acre, and a high rating would exist for 1995 fuel loadings greater than 30 tons per acre. For most treatment areas, the fuel loading has increased due to additional mortality, and the fire potential has correspondingly increased from 1995 conditions.

Figure 3-17 Fuel Loading and Fire Potential

Treatment Areas	Fuel Loading Tons/Acre (Year 1995)	Estimated Fire Potential (Year 1995)	Photo Series Page	Estimated Fire Potential (Year 2020)
D-3	48	HIGH	124	HIGH
D-4	48	HIGH	124	HIGH
F-3	22 to 48	HIGH	90 & 124	HIGH
A-9	60	MEDIUM	136	HIGH
B-4	40	MEDIUM	114	HIGH
C-1	60	MEDIUM	138	HIGH
C-3	60	MEDIUM	136	HIGH
C-8	49	MEDIUM	126	HIGH
D-1	40	MEDIUM	112	HIGH
E-1	40	MEDIUM	112	HIGH
E-2	33	MEDIUM	104	HIGH
D-2	40 to 60	MEDIUM TO LOW	112 & 138	HIGH
F-1	11 to 51	LOW TO HIGH	76 & 130	MEDIUM TO HIGH
A-7	11	LOW TO MEDIUM	76	MEDIUM
C-2	20 to 34	LOW TO MEDIUM	86 & 104	MEDIUM TO HIGH
A-1	33	LOW	102	HIGH
A-3	32	LOW	102	HIGH
A-6	9	LOW	72	MEDIUM
A-8	60	LOW	138	HIGH
A-11	7 to 9	LOW	70 & 72	MEDIUM
C-4	70	LOW	140	HIGH
E-4	11	LOW	76	MEDIUM
C-6	unknown	unknown	N/A	unknown
C-7	unknown	unknown	N/A	unknown
D-5	unknown	unknown	N/A	unknown
E-3	unknown	unknown	N/A	unknown
G-1	unknown	unknown	N/A	unknown
G-2	unknown	unknown	N/A	unknown
G-3	unknown	unknown	N/A	unknown
G-4	unknown	unknown	N/A	unknown
G-5	unknown	unknown	N/A	unknown
G-6	unknown	unknown	N/A	unknown

As previously discussed, the stand structure is changing due to the high mortality of the spruce component. Studies of dead standing spruce on the White River National Forest have shown that within 20 years after dying, 72 percent of the beetle-killed trees of all sizes were still standing and 28 percent were down (Journal of Forestry, 1950). Studies of dead standing spruce on the Dixie National Forest have shown that within 25 years after dying, 84 percent of the beetle-killed trees of all sizes were still standing and 16 percent were down (Journal of Forestry, 1950).

For those areas that average 30 tons/acre of down and dead woody fuels the fire potential rating would be low to medium, the rate of spread would be medium, the fire intensity would be medium, the torching would be medium, crowning would be low, resistance to control would be medium and the overall potential would be medium (based on an above average high fire danger of: 85 to 90 degrees Fahrenheit, 15 to 20 percent Relative humidity, 10 to 15 miles per hour winds, and 4 weeks since measurable rain). Over time, as the dead spruce trees fall to the ground, the average fuel loading will more

than double (from 30 tons per acre to more than 70 tons per acre). For those areas that could have 70 tons/acre of down and dead woody fuels the fire potential rating would be medium to high, the rate of spread would be high, the fire intensity would be high, the torching would be medium, crowning would be low, resistance to control would be high and the overall fire potential would be high (based on an above average high fire danger of: 85 to 90 degrees Fahrenheit, 15 to 20 percent Relative humidity, 10 to 15 miles per hour winds, and 4 weeks since measurable rain).

Also, the average size of the ground fuels will change over time adding more fine fuels (size less than 3 inches in diameter). This addition of fine fuels will increase the rate of spread until the finer fuels are broken down during heavy snow pack years. This, along with the exposure to local wind influences, could increase the probability of high intensity localized fire occurrences in extreme drought years. Low decomposition rates and much higher fuel loadings across portions of the landscape are expected to result in larger wildfires than have been previously experienced if nothing is done to remove or treat the fuels.

Expected fire behavior will generally be confined in the stands of dead spruce. There is a moderate to high potential for fire starts in standing dead spruce to spot across drainages into adjacent stands of dead timber. Consequently, it would be anticipated to experience hot, intensive wildfires burning in blocks ranging from 100 to 500 acres in size across the project area.

3.8 WILDLIFE RESOURCES (Issue #7)

The Forest Service Manual (USDA Forest Service, 1995b) and the Forest Plan (p. III-22) state that wildlife habitat should be maintained to provide for viable populations of existing and approved introduced wildlife species.

MANAGEMENT INDICATOR SPECIES

The Forest Plan identifies the following terrestrial and avian management indicator species: mule deer, elk, blue grouse, and golden eagles.

Deer and Elk

The Herd

Deer seasonally use the project area. The deer found in the project area are part of a greater Manti herd. Deer populations are below herd objectives, but are steadily increasing (Jones, 1998).

An elk herd of about 2,500 animals is also found within the project area and is part of a larger Wasatch Plateau elk herd of more than 11,000 animals (Jones, 1998). This is part of the largest elk herd in the State of Utah. Approximately 20 percent of the total elk harvested in the State comes from the Wasatch Plateau. In the project area, elk generally use late spring, summer, and fall habitat within the upper reaches of Ferron Canyon, Twelve Mile Creek, Timber Canyon, and the Muddy Creek drainage.

Deer and elk inhabiting the project area are important ecologically and economically. Economically, the South Manti herds provide great hunting and viewing opportunities for many recreationists throughout the State. According to the Utah Big Game Annual Report (1996), it is estimated that more than 1,100 people hunt elk within the project area for a total of more than 5,300 hunter days. A similar number of people hunt deer in the project area for about half the number of hunter days as for elk. The number of hunter days is generally weather dependent for both deer and elk hunting.

Habitat

Within the project area, late spring, summer, and fall habitat primarily provide hiding/security cover and forage for deer and elk (summer range) (Jones, 1998). Hiding cover is defined as vegetated areas where brush/trees are tall or dense enough to hide

90 percent of an animal (in this case, deer or elk) at 200 feet. Forage is defined as natural openings, burns, or harvested areas which provide an adequate level of browse and non-woody plants for food.

Hiding/security cover is the primary habitat provided by the stands of trees within the project area. The stands of conifer/aspen provide both forage and cover, while stands of conifer provide mostly cover. However, the function of the conifer trees is rapidly decreasing due to the loss of the overstory canopy due to spruce beetle-induced mortality. Recent wildlife surveys (1998) have found deer and elk occupying these habitats. Survey observations recognized that slash, downed logs, and other woody material (at forest edges, especially within the conifer/aspen areas) are important to deer, elk, and their young for providing additional cover/hiding security areas. Even prior to the spruce beetle infestation, the amount of cover in the project area was limiting during the general elk hunt. During this hunt, elk have been known to move to lower elevations off the Forest in an effort to avoid hunters (Jones, 1998).

There is no winter range in the project area. Portions of conifer/aspen and aspen stands that are near water are especially important for deer and elk calving and fawning habitat. Most of these areas are found at mid-elevations which occur generally outside the treatment areas. In the calving and fawning areas, does and cows give birth and the young spend their first few critical weeks of life.

Cover/Forage Ratios

For big-game, the Forest Plan states that the, "optimum habitat mix for the daily normal range is: 25 percent hiding cover, 15 percent thermal cover, 10 percent hiding or thermal cover, and 50 percent foraging". Currently, the condition of the project area contains 48 percent cover (hiding and thermal) and 52 percent forage. This meets Forest Plan direction. However, the spruce beetle infestation is rapidly changing the stand structure within cover habitat areas due to the loss of crown cover represented by spruce tree mortality. Schmid and Frye (1977) state that deer and elk can benefit from the loss of canopy cover from beetle activity because forage production increases. However, such a benefit is important only in areas, and at times, when forage is limiting. Forage is not limited in the project area. Therefore, for the project area, the adverse effect of reduced cover (increased vulnerability) is not counter balanced from an increase in forage.

Habitat Effectiveness/Road Density

During the summer, big-game prefer habitats where they are least disturbed. Vehicles are a major disturbance to big-game. Studies have shown that big-game will avoid areas up to one half mile wide on each side of a road. This distance depends on topography, existing vegetation, and vehicle use level of the roads. Avoidance of this habitat decreases the effectiveness of the habitat in providing big-game needs. A variety of habitat effectiveness models have been developed to predict this avoidance of areas by big-game (Lyon, 1979).

Within the project area there are 93 miles of Forest Development Roads, nonsystem roads, and motorized trails. This road access correlates to a road network density of about 2.4 miles per square mile. High road densities increase elk vulnerability during the hunting seasons. Increased vulnerability leads to fewer and younger bucks and bulls, and lower male to female ratios in the herds. In a 1987 survey of Utah hunters, the majority of hunters indicated that they would prefer reducing hunting pressure if it created a scenario by where the subsequent harvest had a higher proportion of mature deer (Austin and Jordan, 1989).

Blue Grouse

Blue grouse can be found year round in much of the area. Stands of trees that are adjacent to open sagebrush/grass/forb vegetative types are particularly important to grouse during the mating season. Aspen habitats are most important to blue grouse as brooding areas during the late summer and fall. During the breeding season, dense understory within aspen is essential. Insects are abundant and cover and security is available for nesting (Bunnell, 1978). During the winter, mature stands of fir (especially Douglas-fir) provide food and protection from the elements. Because of the preference for Douglas-fir, which is found mostly at mid-elevations, populations of blue grouse are more dense at lower elevations than they are in the project area. With the recent beetle infestation and subsequent loss of mature conifers, grouse habitat and populations have likely been adversely impacted from these natural occurrences (Schmid and Frye, 1977).

Golden Eagles

During the late spring, summer, and fall, golden eagles can be seen in the area. Some foraging opportunities are available within the area for golden eagles. No eagle eyries have been found in or near the project area. It is suspected however, that eagles observed in the area come from nesting sites along the cliffs at lower elevations to the west and east. Eagles are opportunists, feeding on a variety of prey. Main sources of prey found within the area are rodents or other small mammals such as hares and rabbits. This prey can be found in open and forested habitats. In the general area of southeastern Utah, golden eagle populations appear to be increasing (Utah Division of Wildlife Resources, 1990).

TREE CAVITY DEPENDANT SPECIES

Although no specific surveys were conducted for tree cavity dependant species, except for the Three-toed woodpecker, incidental observations documented the presence of cavity nesters within the area. Cavity nesters most commonly found in the project area include: Northern flickers, yellow-bellied sapsuckers, Northern three-toed woodpeckers, tree swallows, hairy woodpeckers, downy woodpeckers, and mountain blue birds (District files). It is assumed that these species occur in the area on a regular basis, even if at low numbers. Toone (1992) conducted a general survey for three-toed woodpecker within the Muddy Creek drainage. Survey results identified numerous three-toed woodpeckers including hairy, downy, and yellow-bellied sapsuckers. (See the following section on sensitive species for more information about the Northern three-toed woodpecker.)

The cavity nesters in the area use mostly large snags in forested areas of mixed-conifer, conifer/aspen, and aspen to nest and forage in. Suitable habitat for cavity nesters is widely present across the project area, including aspen areas which some nesters prefer. The spruce beetle infestation has created over 11,000 acres of prime nesting and foraging habitat across the area. Recent salvage harvest of beetle-killed spruce has slightly reduced the available snag habitat. Management strategies for tree cavity dependant species have been aimed at maintaining or retaining suitable habitat in areas associated with recent harvesting.

PROPOSED, THREATENED, ENDANGERED AND SENSITIVE SPECIES

Proposed, Threatened and Endangered Animal Species

The following proposed, threatened and endangered species may be influenced by the project: Canada lynx, bald eagle, peregrine falcon, and southwest willow flycatcher. Information regarding these species and potential effects is contained in Appendix J - Biological Assessment.

Sensitive Animal Species

There are five vertebrate Forest Service Region 4 sensitive species known or suspected to occur on the Manti Division: spotted bat (*Euderma maculatum*), Townsend's big-eared bat (*Corynorhinus townsendii*), flammulated owl (*Otus flammeopus*), Northern goshawk (*Accipiter gentilis*), and Northern three-toed woodpecker (*Picoides tridactylus*).

Spotted Bat

Spotted bats occur in scattered areas throughout Utah. They have been found in a variety of habitat types including open ponderosa pine, desert scrub, pinyon-juniper, and open pasture and hay fields. They roost alone in rock crevices high up on steep cliff faces. Cracks and crevices ranging in width from 0.8 inches to 2.2 inches in limestone or sandstone cliffs are critical roosting sites. There is some evidence that individuals show fidelity to roost sites. Spotted bats are territorial and avoid each other while foraging. They are thought to migrate south for winter hibernation. Spotted bats are rare and may be limited by suitable roosting sites. They are found in relatively remote, undisturbed areas, suggesting that they may be sensitive to human disturbance. Little is known about the spotted bat's food habits. They are thought to feed mainly on moths. Their echolocation call is very effective for fast flight feeding on moths. They forage alone, after dark, and avoid each other by listening to the echolocation calls of others (Leonard and Fenton 1983; Woodsworth et. al., 1981; Watkins, 1977).

In the summer of 1997, surveys detected spotted bats within the following areas outside of the project area: Mill Fork Canyon, Crandall Canyon, Biddlecome Hollow, Tie Fork, Huntington Canyon, and Bear Creek Canyon. Although these are areas are outside the project area, they are within the Wasatch Plateau where most suitable habitat exists. To date, the only known sightings of spotted bats located in the South Manti area have been at Emerald Lake. It is believed the bats located at this site roost in the limestone cliffs found throughout the area.

Except for some available limestone cliffs found throughout the area, the treatment areas do not contain much suitable roosting habitat. Only about 2 to 5 acres of rock/cliff habitat may support roost sites within the Camel Rock quarries, which have been used as a source of road gravel (Camel Rock Quarry Biological Evaluation, 1997).

Spotted bat foraging habitat is associated mainly with riparian areas. Such sites can be found within the project area. Foraging is probably the primary use the spotted bat will exhibit within the area.

Townsend's Big-Eared Bat (Western Big-Eared Bat)

Townsend's or Western big-eared bat use a variety of scrub and forested habitat throughout Western North America. These bats use juniper/pine forest, shrub/steppe grasslands, deciduous forests, and mixed coniferous forests from sea level to 10,000 feet in elevation. These bats use colonial nurseries. Cool places such as caves, rock fissures, mines, and buildings are used for roosting and hibernation. Foraging of primarily moths is often done in open woodlands, along forest edges, and over water.

The Townsend's big-eared bat occurs throughout Western North America including Utah. During the winter they roost singly or in small clusters. They remain at these sites from October to February. Migration for these bats usually means a change in location in the same cave or to another nearby cave.

The Townsend's big-eared bat is very sensitive to human disturbance. It will readily abandon roosts when disturbed. Activities that will or may disturb caves or mines should be evaluated to determine potential impacts to this species (Kunz and Martin, 1982; Utah Division of Wildlife Resources, 1990).

Bat surveys in the last two years on the Forest have not located any Townsend's big-eared bats (Johansson et. al., 1997). This bat has been documented using

inactive coal mines as hibernaculum on the District and they have been found roosting in buildings in the town of Ferron. Limited surveys within the project area resulted in no findings of the Townsend's big-eared bat. However, it is possible they utilize the area at least seasonally for foraging and roosting.

Flammulated Owl

Flammulated owls are found throughout the western United States including Utah. They can be found in the mixed-pine forests, from pine mixed with oak and pinyon at lower elevations to pine mixed spruce and fir at higher elevations. Flammulated owls have also been found in aspen and second growth ponderosa pine. However, they prefer mature ponderosa pine/Douglas-fir forests with open canopies. Large diameter dead trees with cavities are important nest site characteristics. They avoid foraging in young dense stands where hunting is difficult. Flammulated owls are dependant upon mature conifer stands for nesting. They are also known to avoid open harvested areas. Flammulated owls are almost exclusively insectivorous, preying on small to medium sized moths, beetles, caterpillars, and crickets (Reynolds and Linkhart, 1987; Johnsgard, 1988; Bull et. al., 1990).

Flammulated owls have been found in the Quitcupah drainage and the head of the Muddy Drainage on Ferron/Price Ranger District. All but one of these locations have been associated with ponderosa pine. The location in the head of the Muddy Drainage is within the project area. This sighting was a vocalization believed to be from a flammulated owl, that was heard while conducting owl surveys. This "sighting" was not confirmed visually.

Nesting habitat can be found in some areas where spruce stands contain Douglas-fir. These areas are usually located along ridge-tops and upper slopes. The best habitat found in the project area for nesting owls is located in the only stand of Douglas-fir near Julius Flat Reservoir (in the southern portion of the project area). Spruce beetle-induced tree mortality, which causes a change in stand canopy, may have reduced habitat by creating a closed understory condition that is not favored for foraging.

Northern Goshawk

Goshawk forage and nest in dense forest settings. Goshawks have been found in a variety of forest ecosystems including lodgepole pine, ponderosa pine, Douglas-fir, and mixed forest throughout much of the Northern hemisphere. They prey upon small mammals and birds (rabbits, squirrels, chipmunks, grouse, woodpeckers, jays, robins, grosbeaks, etc.). Goshawk nest sites are usually located in mature forests near water, and on benches of relatively little slope. Nests are often used year after year. Goshawks are very protective of their young in the nest and loudly defend them to intruders. They are very sensitive to human disturbance and have abandoned nests and young due to human activities that take place too close to their nest (Kennedy and Stahlecker, 1993; Hennessey, 1978).

Goshawk are a summer resident of the Wasatch Plateau, with the number of nesting birds varying from year to year. Nest sites on the Plateau are typically associated with seral aspen forest types. Seventeen percent of the area contains suitable Goshawk habitat. Surveys have found two nest territories with multiple nests within the project area. Other nest sites have been located in the project area but it is not known for sure which raptor species have utilized them. It is possible that additional territories have been established in the area as well.

Range and timber management are the primary resources emphasized by the Forest Plan within the project area. These management actions can decrease goshawk habitat by removing cover and food for prey species and removing large trees for nesting purposes. Also, these actions can indirectly interfere with fire regimes and natural forest succession. In order to address the current management direction in regards to the goshawk, the Forest Service will employ the recommendations in the Conservation Strategy and Agreement for the Management of Northern Goshawk Habitat in Northern Utah (USDA Forest Service, 1999) as a tool to conserve, restore, and protect native processes and disturbed habitats.

Northern Three-Toed Woodpecker

Three-toed woodpeckers range across North America. They are found in northern coniferous and mixed forest types up to 9,000 feet in elevation. Forests containing spruce, grand fir, ponderosa pine, tamarack, and lodgepole pine are used by these birds. Nests may be found in spruce, tamarack, pine, cedar, and aspen trees. About 75 percent of their diet is wood-boring insect larvae, mostly beetles, but they also eat moth larvae. Although three-toed woodpeckers are major predators of the spruce beetle, they are not effective in significantly reducing epidemic population levels. They forage on a wide variety of tree species depending on location. In Colorado, they prefer to forage on old-growth and mature trees. Fire-killed or insect-killed trees are major food sources. Forest fires and areas of insect outbreaks may lead to local increases in woodpecker numbers after 3 to 5 years (Bull et. al., 1986; Scott et. al., 1980). This birds likely progress across the landscape in response to cyclic beetle activity.

Prior to the current spruce beetle outbreak, suitable habitat for the three-toed woodpeckers was present throughout the area in spruce/fir and conifer/aspen stands, most likely associated with small, localized areas of insect activity. In addition, woodpecker activity is present in trees killed by other factors like root rot or fire. The spruce beetle outbreak has created over 11,500 acres of prime three-toed woodpecker habitat across most of the area, and it is expected that colonization to the area will continue within the near future. To this point, of the 11,500 naturally-created habitat, approximately 2,500 acres have been or will be harvested. Management strategies have been aimed at maintaining or retaining suitable habitat in places associated with harvested areas.

Recent surveys for the three-toed woodpecker have been made throughout the project area. High concentrations were found in areas where the spruce beetle have killed large numbers of trees.

Regulatory Framework

Under the Endangered Species Act, it is Forest Service policy to analyze potential impacts to threatened and endangered species (refer to Appendix J - Biological Evaluation). Although not required under the Endangered Species Act, it is also Forest Service policy to analyze potential impacts to species proposed by the Fish and Wildlife Service for listing as threatened or endangered and sensitive species (USDA Forest Service, 1995b). Sensitive species are those identified by the Forest Service Regional Forester as, "those species for which population viability is a concern, as evidenced by significant current or predicted downward trends in population numbers or density" or "significant current or predicted down-ward trends in habitat capability that would reduce a species' existing distribution," (USDA Forest Service, 1995b).

Neotropical Migratory Birds

Neotropical migratory birds are species that nest and raise young in North America and migrate to tropical areas in Mexico, the Caribbean, and Central and South America in the winter. These forest birds play an important role in the control of forest insect populations. Many of these species depend on interior forest conditions to provide for their habitat needs. Approximately 150 species, including numerous warblers, vireos, tanagers, grosbeaks, flycatchers, hummingbirds, wrens, and thrushes migrate through or winter in more than a dozen countries.

A large landscape-level Neotropical bird survey was conducted on the Ferron District in 1993 and 1994. Neotropical migratory birds can be found within the project area. Songbirds were mostly found within forest edges (especially aspen/conifer) using the thick understory for nesting and foraging. The larger trees were used for perching and escape. A large variety of birds were found to be more concentrated in those areas where understory vegetation was abundantly available. The interior forest displayed less birds, especially where slash and downed woody material were the prevalent understory. This was primarily within the pure spruce/fir stands. Mountain blue birds were seen mainly in the open grass/forb parks next to the forest edge. Other bird species observed (some are not Neotropical migrants) include: Clark's nutcracker (*Corvus corax*), gray jay (*Perisoreus canadensis*), Stellar jay (*Cyanocitta stelleri*), Northern goshawk (*Accipiter gentilis*), sharp-shinned hawk (*Accipiter striatus*), American robin (*Turdus migratorius*), redtail hawk (*Buteo jamaicensis*), Swainson's thrush (*Catharus ustulatus*), golden eagle (*Aquila chrysaetos*), and mourning dove (*Zenaidura macroura*). Mallards, teal, and spotted sandpipers are some migrant aquatic species that can be found in wetland areas within the area.

The Manti Division contains a variety of forested types that provide suitable habitat for Neotropical migrants. Like the Manti Division, the project area generally exhibits natural fragmentation with some human influence. Typically, large to small continuous forest types with large and small open parks are scattered throughout the area. Forest types include mixed-conifer spruce/fir to mixed-conifer/aspen and aspen ranging from 5-acre to 300-acre continuous tree stands. These are intermingled with open grass/forb, grass/forb/rock, shrub/grass/forb, and barren parks. Natural conditions (i.e. loss of interior forest due to the beetle outbreak) are rapidly altering the habitat, especially for those forest interior species dependant on thick forest stands. Spruce/fir stands previously cut are presently managed for future interior forest habitats through reforestation practices.

Other Wildlife

The project area supports a variety of other wildlife species as documented in recent surveys and/or incidental observations. Tree squirrels and ground squirrels are utilizing open and forested habitats in and around the area. Additional raptor nest sites have been located, probably accipiter species or buteo species, thereby establishing breeding territories. In the high elevation flats of the project area, Harrier Hawks can be seen hunting. The most common bird species observed were the mountain chickadee (*Parus gambeli*), dark-eyed junco (*Junco hyemalis*), white crowned sparrow (*Zonotrichia leucophrys*), red breasted (*Sitta canadensis*) and pygmy nuthatch (*Sitta pygmaea*), hairy woodpecker (*Picoides villosus*), Northern three-toed woodpecker (*Picoides tridactylus*), Northern flicker (*Colaptes auratus*), and the pine grosbeak (*Pinicola enucleator*). Bear, snowshoe hares, badgers, and chipmunks are common in and out of the forested areas. Ducks are observed utilizing the lakes and mountain ponds. Old and current beaver activity is evident within the riparian zones. In the late fall and early spring, many migratory bird species fly through the area. Most noticeable are the large hawks and eagles. One can expect to find great-horned owl and long-eared owl pairs in many of the forested sites. Observations by District personnel indicate the presence of many other species that utilize the area.

3.9 TRANSPORTATION (Issue #8)

The area of analysis for transportation planning contains 70 miles of Forest Development Roads, 18 miles of nonsystem roads, and 5 miles of motorized trails in an area of 38.4 square miles. This count includes arterial, collector, and local roads shown on the Forest Travel Map. Also included in this count are roads that have been field or photo identified since release of the Forest Travel Map, and therefore are not shown on the travel map.

Road Density

The current Forest Development Road, nonsystem road, and motorized system trail access density is 2.4 miles per square mile.

Traffic Uses

The Ferron-Mayfield Road (Forest Development Road #50022) provides east-west access across the Forest between the towns of Ferron and Mayfield. This road currently carries an average of 200 vehicles per day on the west side and between 24 and 89 vehicles per day on the east side. Use on the west side is 50 percent recreation, 17 percent fuelwood activities, 15 percent range activities, and 18 percent timber activities. Use on the east side is 87 percent recreation, 3 percent fuelwood activities, and 10 percent range activities.

The Skyline Drive (Forest Development Road #50150) currently carries an average of 100 vehicles per day on the south side and between 23 and 33 vehicles per day on the north side. Use on the south side is 65 percent recreation, 0 percent fuelwood, 25 percent range, and 12 percent logging activities. Use on the north side is 68 percent recreation, 7 percent fuelwood activities, and 25 percent range activities.

The Link Canyon Road (Forest Development Road #50044) currently carries between 1 and 13 vehicles per day with 30 percent recreation, 12 percent fuelwood activities, and 58 percent range activities.

The Sixmile Road (Forest Development Road #50047) currently carries between 4 and 17 vehicles per day with 71 percent recreation, 10 percent fuelwood activities and 19 percent range activities.

The Duck Fork Road (Forest Development #50049) is a higher volume local road that currently carries up to 17 vehicles per day with 84 percent recreation, 4 percent fuelwood activities, and 12 percent range activities.

The remaining local roads have traffic volumes of under 10 vehicles per day with peak use occurring from recreation activities during the big-game hunting seasons.

Existing Aggregate Sources and Use Status

Three existing aggregate (gravel) sources are located within the project area: Camel Rock North, Camel Rock South, and Baseball Flat source. Camel Rock North (located in Township 19 South, Range 4 East, section 38) occupies approximately 4.5 acres. Camel Rock North is currently inactive and scheduled to be reclaimed. This source has been exhausted and will no longer serve as a source of gravel. Camel Rock South (located in Township 19 South, Range 4 East, section 33) occupies approximately 4.5 acres. This source was entered in the fall of 1997 and summer of 1998 to produce crushed aggregate. The Baseball Flat aggregate source (located in Township 20 South, Range 4 East, section 19) has been entered since 1994.

Travel Time, and Delay

On Forest Development Road #50022, the Ferron-Mayfield Road, travel time is presently about 1 hour from Mayfield to the Twelvemile Campground. A traveler can expect approximately 0.8 minutes delay per hour of travel due to encounters and needing to pull over for passing. Due to current road construction, travelers are experiencing increased travel time in construction areas. All existing authorized construction is scheduled to be completed in 1999.

Existing Haul Route

Forest Development Road #50022, the Ferron-Mayfield Road, is the arterial serving the Oley, Olga, Baldy, and Camel Timber Sales. Duck and Six Timber Sales will also use this road to haul timber. Roadside turnouts were improved and additional aggregate was placed in 1997. This section of the Ferron-Mayfield Road has aggregate surfacing to Twelvemile Flat. The collector road serving these sales is Forest Development Road #50150, Skyline Drive. Skyline Drive received road improvements such as additional roadside turnouts, replaced culverts, and aggregate surfacing, from Forest Development Road #50022 junction to Forest Development Road #50044 junction. Approximately 0.7 miles of Link Canyon Road also received similar improvements.

Forest Development Trails

In addition to roads, there are three established motorized system trails with a combined mileage of approximately 5 miles in the project area that are used by recreation traffic: Trail #003, Trail #122, and Trail #007. Trail #003 is within treatment areas D4 and D5 (1.8 miles). Trail #007 is adjacent to treatment area F3 (1.3 miles). Trail #122 partially resides within treatment units G1 and G2 (1.4 miles). It is estimated that 3 to 5 people per day use these trails during big-game hunting seasons.

User Access

Forest visitors can usually access the higher elevations on the Forest between July 1st and October 31st. Snowdrifts can inhibit or restrict access, and may sometimes be found beyond July 1st. Early snows can also close people out prior to October 31st.

Vehicle travel off roads is common during State and Federal holidays and big-game hunting seasons. Each year some roads are lengthened or unapproved roads are created by forest users. Based on a 1995 road inventory, there are approximately 18 miles of nonsystem roads across the project area which are not needed for future resource management.

3.10 RANGE ALLOTMENTS AND IMPROVEMENTS (Issue #9)

There are four cattle and eight sheep allotments that occur, partially or wholly, within the project area. A total of 5,377 cattle and 9,223 sheep graze on these allotments during the grazing season (6/20-9/30) for a total of 32,496 Animal Unit Months (AUMs) of use. These livestock are owned and managed by 77 permittees, mainly from the communities of Emery, Ferron, Manti, and Mayfield. It is estimated the forage produced on the Forest provides 25 percent of the yearly forage needs for the base herd and 50 percent of the forage needs for the calf and lamb crop. This high percentage of the required forage is critical in order to maintain livestock operations for most operators. The livestock grazing allotments within the project area are listed in Figure 3-18 Range Allotments.

Figure 3-18 Range Allotments

Sanpete Ranger District	Ferron/Price Ranger District
Twelvemile Cattle Allotment	Emery Cattle Allotment
Sixmile Cattle Allotment	Ferron Cattle Allotment
Island Lake Sheep Allotment	Blue Lake/Lake Fork Sheep Allotment
Sixmile Sheep Allotment	Peavine Flat Sheep Allotment
	Heliotrope Sheep Allotment
	Indian Creek Sheep Allotment
	Duck Fork Sheep Allotment

Forage used by livestock and wildlife is produced mostly in the grass-forb, aspen mountain brush, and riparian types within the project area. Some forage is available in the open timber types that occur in the canyon bottoms and on the gentle slopes. Dense timber stands are used rarely by livestock due to the lack of available forage plants, steep slopes, and poor access. Since forage is not a limiting factor for big-game needs, livestock use of forage is not a competing use in the project area.

3.11 VISUAL
LANDSCAPE
(Issue #10)

The Forest Plan assigned a Visual Quality Objective (VQO) to each area of the Forest reflecting the desired management emphasis (see Figure 3-19 Visual Quality Objectives Map).

Some of the VQOs assigned by the Forest Plan allow a noticeable degree of change from the existing condition. Three VQOs assigned by the Forest Plan exist within the project area: Retention (management activities are not visually evident to the casual observer); Partial Retention (management activities remain visually subordinate to the characteristic landscape); and Modification (management activities may visually dominate the landscape, but must borrow from naturally established form, line, texture, and color so they appear similar to natural occurrences).

Forest resource uses or activities should meet the adopted VQO as displayed on the Forest Plan Planned Visual Quality Objective Map; design and management activities should be implemented to blend with the natural landscape (Forest Plan, p. III-17).

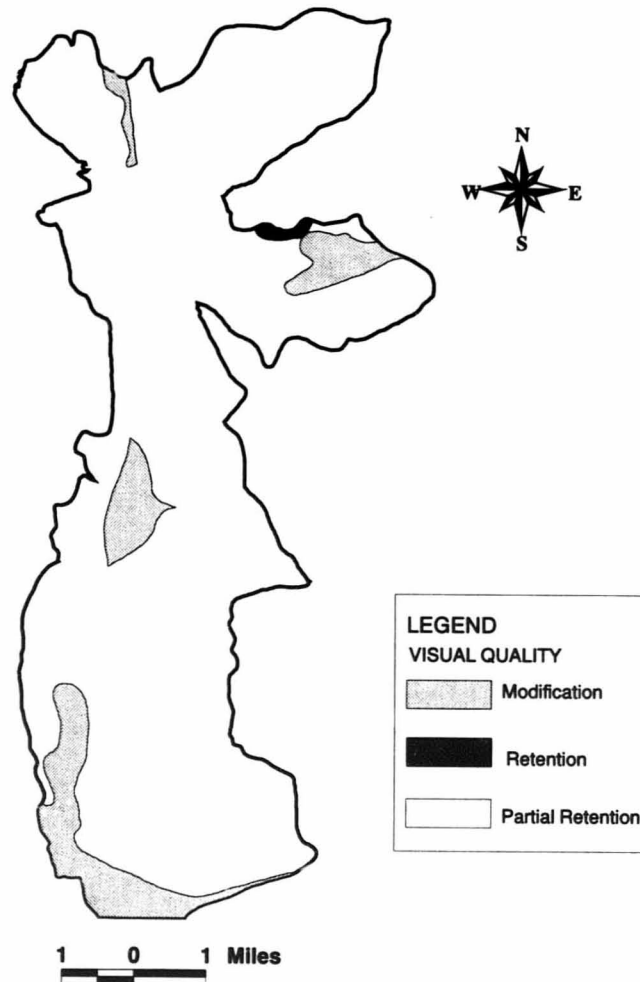
Existing Visual
Condition

Visual sensitivity usually varies along any travel corridor. Exceptional views are available from Skyline Drive (Forest Development Road #50150), portions of the Great Western Trail, the proposed Castle Valley ATV Trail System, the Ferron-Mayfield road (Forest Development Road #50022) near Ferron Reservoir and Willow Lake, and at points above lakes and reservoirs, deep or expansive drainages, and steep facing slopes. Views from areas of concentrated recreation use (both dispersed and developed) outside of these travel corridors have been classified relative to those who may be fishing, camping, or enjoying the view from their cabin window. Sites of this type are Duck Fork Reservoir, Emerald Lake, Blue Lake, the Ferron Reservoir Recreation Complex (including views from cabins and residences), and Twelvemile Flat Campground.

In summary, the viewsheds associated with major roads and trails in the area have high visual value. They are characterized by mountainous terrain which includes rock formations and glacial cirques, panoramic ridge and valley views (some containing lakes or reservoirs), and wildlife; resulting in attractive, yet accessible, subalpine scenery. Lands adjacent to these corridor viewsheds also considered for timber management possess varying degrees of visual sensitivity due to potential recreation use.

FIGURE 3-19

Visual Quality Objectives Map



3.12 UNDEVELOPED CHARACTER
(Issue #11)

The Forest Plan does not provide specific direction or a desired condition for Undeveloped Character, nor does it define what it is. Undeveloped Character is the sense that a person gets of remoteness and isolation by the absence of people and their associated activities. For purposes of this analysis, only human-caused effects will be evaluated when considering Undeveloped Character. Measures of this evidence in the project area will be motorized access network densities (roads and trails), past and current harvest activities, improvements associated with cattle and sheep allotments and their use, developed and dispersed recreation sites, the experience classes established by the Recreation Opportunity Spectrum (ROS) System, and the area's scenic condition. The level at which the area achieves each of these characteristics will be the basis of evaluating Undeveloped Character.

Roads and Trails

Presently, there is a road/trail density of 2.4 miles of motorized network per square mile distributed across the project area. This includes 70 miles of Forest Development Roads, 18 miles of nonsystem roads, and 5 miles of system motorized trails. Forest Development Roads typically have a 14 foot wide road surface with an additional 4 feet of clearing of vegetation on each side of the roadway (cut and fill slopes are typically associated with these roads). Nonsystem roads typically are less than 10 feet wide and do not have associated roadside clearing of vegetation or cut and fill slopes. Motorized system trails are generally less than 5 feet wide. Minor cut and fill slopes may be associated with them.

Harvest Activities

There are past and present timber sales within the central and northern portions of the project area. Past timber sales in the area include the 1992 Timber Canyon Timber Sale (330 acres), 1993 Twelvemile Timber Sale (205 acres), the Camel Timber Sale (13 acres), and personal use firewood cutting. Current timber sales in the area include Baldy (498 acres), Duck (726 acres), Oley (151 acres), Olga (173 acres), and Six (351 acres).

Recreation Sites

Developed recreation sites include the Twelvemile Campground and the Ferron Reservoir complex. These developed areas are highly used from approximately July 1 through October. Dispersed recreation sites exist throughout the project area, with higher concentrations near water and along access routes. Six Undeveloped Motorized Recreation sites have been identified in the Forest Plan (see Figure 3-1 Forest Plan Management Units). These sites are used by hikers, fishermen, and hunters. The heaviest use is by fishermen in the summer and hunters during the fall. There is limited winter recreational use of the area, most of which is snowmobiling.

Range Allotments

There are four cattle allotments (5,377 cattle) and eight sheep allotments (9,223 sheep). These allotments encompass the entire project area. Constructed improvements associated with these allotments are 13 miles of fence, 1 stock pond, 6 troughs, and 4 corrals. Grazing occurs annually from June through September.

Recreation Opportunity Spectrum

The Recreation Opportunity Spectrum (ROS) class experience levels for the project area are defined in Figure 3-20 Recreation Opportunity Spectrum Classes. The primary ROS class or condition for the project area is Semi-Primitive Motorized, which has been well interspersed with Roaded Natural Appearing corridors of about one mile in width along the existing roads. Visitors primarily experience the character of the area from along Skyline Drive. The small area around the Ferron Reservoir Recreation Complex has been classified as Rural.

Scenic Condition

The hierarchy of scenic integrity is used as part of the new Scenery Management System (supersedes the USDA Forest Service, 1973 Forest Service Visual Management System) to determine the level of noticeable deviations from the more native character of the landscape. As derived from a visual resource inventory of the project area, the landscape is classified according to how natural it appears relative to the amount and types of human alterations present. These categories of existing scenic condition for the project area are summarized in Figure 3-21 Scenic Condition.

Figure 3-20 Recreation Opportunity Spectrum Classes

ROS CLASSES	DESCRIPTION
Semi-primitive Motorized	Predominantly a natural appearing environment, vegetative alterations are very small in size and number and widely dispersed and visually subordinate.
Roaded Natural Appearing	Less isolation from the sights and sounds of humans, but still opportunity to have a high degree of interaction with the natural environment
Rural	Generally more important than the setting of the physical environment is the high probability of affiliation with humans including associated developed sites and related opportunities.

Figure 3-21 Scenic Condition

SCENIC CONDITION	DESCRIPTION
Natural Appearing	The character of the landscape "appears" intact. Management activities are not readily evident. The vegetation appears undisturbed, but a single road might be visible, especially in natural openings. (7,298 acres; 30% of project area)
Slightly Altered	The character of the landscape "appears" slightly altered. Noticeable deviations remain visually subordinate to the surrounding natural landscape character. (15,458 acres, 63% of project area)
Moderately Altered	The character of the landscape "appears" moderately fragmented. Timber harvesting is more noticeable as units begin to contrast with their surroundings and stand out in the landscape. They either blend well enough with their surroundings or there are so few of them that they do not completely dominate the scene. The level of disturbance is moderate. This would include areas of recovering older intensive harvest that blend moderately well into their surroundings, as well as areas where there may be one or two recent intensive harvest units and a road that do not blend. (1,818 acres, 7% of the project area)

These categories or scenic conditions can be meaningfully converted to Visual Quality Objectives (VQO) outlined by the old Visual Management System using a "crosswalk" that is provided in the new Scenery Management Handbook (USDA Forest Service, 1995a). By referring to the visual inventory of the existing condition as determined during the Forest planning process, we can approximate the level of Undeveloped Character for the project area. A Natural Appearing Scenic Condition correlates to a Retention VQO. A Slightly Altered Scenic Condition correlates to a Partial Retention VQO. A Moderately Altered Scenic Condition correlates to a Modification VQO.

Overall, the project area has been impacted and influenced by people and their associated activities. Outside of the inventoried roadless areas, it is difficult to find areas that have not been affected based upon the measures described in this section.

3.13 CULTURAL RESOURCES (Issue #12)

Paleontological and Cultural Resources

Paleontological resources include the remains of ancient plants and animals at specific localities. There are numerous plant fossils located in the Cretaceous Blackhawk formation found in the vicinity of the project area. Mammal remains are also present. The partial remains of *Tyrannosaurus rex* has been found in the region immediately east of the project area near North Horn Mountain. In addition, lizards, *Ceratopsians*, *Hadrosaur*, *Alamosaurus*, dinosaur eggs, and dozens more evidence of paleontological mammals has been found. This zone represents a geologic boundary that marks the transition between two great time periods, the Cretaceous and the Tertiary. It marks the period when the dinosaurs became extinct and the mammals became dominant. In addition, various fresh water vertebrates and invertebrates can be found in the Flagstaff Limestone Formation that outcrops at the highest elevations of the project area. Pleistocene mammals (mammoth, mastodons, camels and horses) have been discovered nearby.

Cultural resources consist of sites, structures, and objects used by prehistoric, as well as, historic peoples. Archaeological evidence shows that the prehistoric period lasted from approximately 10,000 to 600 years ago. Based on archaeological findings in the region, evidence for both Paleo-Indian and Archaic occupation of the high elevations in or near the project area are possible. Use and occupation by the succeeding Fremont people from approximately A.D. 400 to 1300 is evident, but may have occurred mostly at lower altitudes. Based on linguistic and archaeological data, new hunting and gathering groups began occupying much of Utah most certainly in the fourteenth century A.D., and perhaps as early as A.D. 1150 to 1250. These groups may be ancestral to the present day Ute, Paiute, or other Native American peoples in the region. Historically, while early explorers such as traders and trappers may have visited the area, little evidence of their passing was left behind. Beginning in 1850, historic records show that Mormon settlements were established in the region. Included within this broad definition are properties holding special significance to the ways of life, tradition, and social institutions of a local ethnic group, especially Native Americans. For a more detailed historical perspective of the early occupants of the Forest, refer to the Forest Plan (pp. II 24 to II-27).

Due to the high altitude of the project area, prehistoric human use appears to have been seasonal, during the summer months, and oriented toward hunting and gathering. Specific use included procurement of raw lithic material; in particular, the chert nodules found in the Flagstaff Limestone Formations that runs generally north-south through the project area. Edible roots, such as pygmy bitterroot (*Lewisia pygmaea*), which is still present at the highest altitudes of the project area, may have also been gathered by prehistoric populations within the project area. Historic evidence of human use appears to be in connection with logging and early ranching activities.

Previous Cultural Resource Work

Prior to 1995, intensive archaeological inventory of the project area had been limited to a few sample surveys of small block areas 80 to 160 acres in size. These block surveys occurred in and around the project area. Approximately 1400 acres were surveyed, using various levels of intensity, and three archaeological sites were recorded.

A predictive model of potential site location for the South Manti project (ML-94-745) was developed in 1994. This model was based mainly on slope percentages. The project inventory began in 1995 in accordance with a Memorandum of Understanding (MOU) with the Utah State Historic Preservation Office (USHPO). The MOU outlines an agreed upon procedure for inventory, recording, and mitigation strategies to ensure that significant historic properties are not affected by the proposed undertaking.

Survey Results for Previous Resource Work

The 1994 survey (ML-94-745) resulted in 2 sites being identified and recorded from 587 acres surveyed. The 1995 survey (ML-95-776) resulted in 8 sites being identified and recorded in 850 acres surveyed. The 1996-97 survey (ML-96-820) resulted in 18 sites being identified and recorded in 1,406 acres surveyed. Total number of historic and prehistoric sites for the project area was 28 in 2,843 acres surveyed. Four of these sites are eligible for the National Register of Historic Places.

Pending Cultural Resource Work

Pending surveys will include new units and unsurveyed, potentially impacted areas. This area will be approximately 100-300 additional acres needing archaeological survey in accordance with the model drafted in the MOU with the USHPO. The total number of new sites predicted to occur on these additional survey acres, based on the model used for cultural resource survey, is up to 4 sites.

In addition, any new or changed road locations, landings, or carry areas will need intensive level archaeological survey.

3.14 ECONOMICS (Issue #13)

The Forest Plan Final Environmental Impact Statement includes a socioeconomic analysis of effects of timber harvest on communities surrounding the National Forest (pp. III-15 and IV-6). The analysis area for this project includes Sanpete and Sevier counties and indirectly Carbon and Emery counties. Timber sales and their associated activities, such as road construction, road reconstruction, and post harvest activities (e.g. tree planting) have an effect on local communities through their impact on employment. Forest management also influences the wood products, government, construction, and recreation sectors. Indirect impacts occur as these sectors conduct additional business with other sectors.

By law, counties receive 25 percent of revenues from Forest Service timber sales. These receipts are designated for use on roads and schools. Local government receipts fluctuate annually depending upon actual timber volume harvested and the price received for the timber. Prices bid for National Forest timber are influenced by a number of factors including the value of the wood products and the operating costs associated with felling and removing the timber from the woods. Operating costs vary by sale depending upon characteristics of the timber, yarding systems, yarding distances and roadwork. Timber sales with higher operating costs reduce sale revenues and, which correspondingly reduce the 25 percent payments to counties.

The analysis for this project will use net sale volumes, estimated costs and revenues, and estimated appraised values as evaluation criteria of the alternatives on local economies and payments to counties. The multiplier for total jobs and income to communities generated as a result of timber harvest is 10.8 jobs per year per million board feet (MMBF) and an income multiplier of \$571,095 per MMBF. This information is based on the Forest's 1997 fiscal year Timber Sale Program Information Reporting System (TSPIRS) report.

The economic analysis is intended to show a relative difference between the alternatives. Operating costs and wood product values are influenced by a variety of factors which can fluctuate unexpectedly and significantly increase or decrease the bid value of a timber sale. For example, in September 1992, 2.9 million board feet (MMBF) of dead spruce sawtimber was sold for \$115 per MBF. In September 1993, the high bid on 2.2 MMBF of dead spruce sawtimber was \$183 per MBF. Nationally and regionally, the reduced availability of Federal timber supplies has led to an increasing amount of privately-owned timber being harvested by both local wood products manufacturers and companies from outside of Utah. Sawtimber is being harvested for both local processing and shipment by rail to other processing facilities outside of Utah. Some private land sawtimber is being shipped to ports in Portland, Seattle, and Los Angeles for export.

A new lumber manufacturing facility was built in Wellington, Utah (6 miles from the town of Price). Sawlogs can be purchased from local sources within a 100-mile radius of the mill. Lumber, pulp, and other by-products would be placed in the local markets or shipped by truck or railroad to Salt Lake City, Denver, Phoenix, or the West Coast. Initially the sawmill employed 30 people with an additional 30 to 40 employees in the logging operations. Mill capacity is approximately 25 MMBF annually. Employment could eventually total 100 employees.

A new log home manufacturing facility was built near Gunnison, Utah. Sawlogs are purchased from local sources within a 130-mile radius of the mill. Manufactured house logs are generally shipped to the Southeastern states for assembly into log homes. Orders for construction of log homes in the local area are increasing. The sawmill employs 30 to 35 people in the mill with an equal number of workers in logging operations. The mill utilizes about 7 MMBF annually, but has a capacity for 25 MMBF annually.

3.15 ENERGY (Issue #14)

For the existing traffic and timber activity of the project area, an energy analysis was performed using "Methods for Evaluating Energy Effects of Forest Management Alternatives" (Schwarzbart and Schmitz, 1982). The following elements were used in this analysis: Forest management, extraction (logging), road construction and maintenance, product transport to mill, mill processing, and non-logging traffic. Existing energy consumption within the project area was estimated at 139,395 Million British Thermal Units per year. Energy output from recent timber sales is calculated at 165,825 Million British Thermal Units per year.

3.16 ROADLESS CHARACTER (Issue #15)

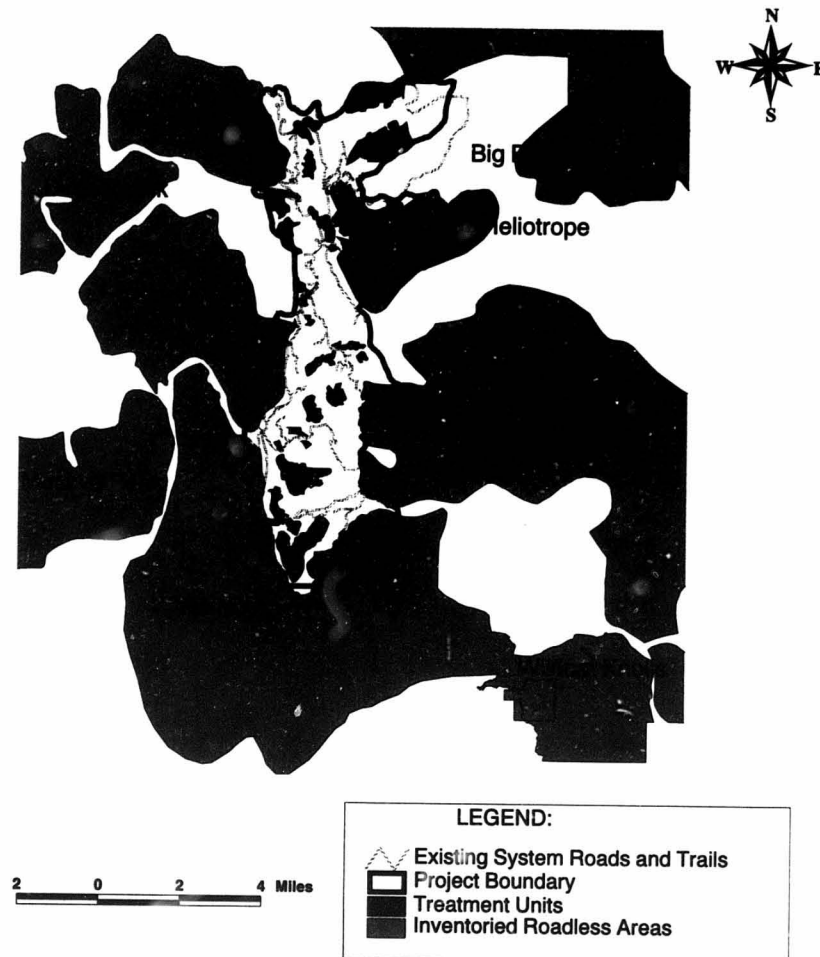
The Forest Plan does not have a section entitled Roadless and does not provide direction or a desired condition for roadless character. This issue involves the effects of road building and associated human activities on the character of the inventoried roadless areas (RARE II and Forest Plan) associated with the project area. This issue is important to many people who may want these inventoried roadless areas kept roadless, unaltered by human activities, or recommended for wilderness. It is equally important to others who want these roadless areas developed and made more easily accessible.

The "roadless" characteristics associated with this issue come directly from the Wilderness Act of 1964 and are the same measures used to analyze each roadless area's eligibility for Wilderness. The level at which each roadless area achieves each of these characteristics portrays the area's condition. The term "roadless character" refers to an area usually of at least 5,000 acres, without developed and maintained roads, and substantially natural. Although the inventoried roadless areas have not been formally recommended for Wilderness, they may still possess a roadless character. This document does not analyze the Wilderness suitability of the roadless areas.

The existing condition for each roadless area has been defined using the Manti-La Sal National Forest Roadless Area Review Evaluation (RARE II) analysis (1982) and the associated briefing guide used for planning efforts related to roadless areas on the Forest. Figure 3-22 Roadless Areas Map, illustrates the location of the six roadless areas in the project area. The narrative description outlines qualitative attributes for each area and is organized by the roadless characteristics.

FIGURE 3-22

Inventoried Roadless Areas Map



Big Bear Canyon

Big Bear Canyon is a 25,782-acre inventoried roadless area identified in the National RARE II analysis. It is located in Sanpete County, Utah (approximately 18 miles from Castle Dale, Utah). Access is from Skyline Drive (Forest Development Road #50150).

Natural Integrity - Use has substantially altered the vegetation and created two-track roads and associated campsites. There are 21.8 miles of existing road, 1.0 mile of fence, and 8 water developments. Watershed activity has effectively divided the Ferron Creek unit, and the undeveloped portion south of Ferron Creek is not unique and is less than 5,000 acres.

Apparent Naturalness - Consistent with all of the other roadless areas located on the Manti division, this roadless area has been extensively used by man historically for grazing and timber harvest. There is moderate evidence of human disturbance to a trained observer. The lands surrounding the area and some intrusions show the same historic use and much evidence of current mechanized activity of watershed and range restoration.

Remoteness - Parts of the area possess a degree of "remoteness" due to relative inaccessibility north of the McEwan Flats area. This area becomes difficult to reach when access roads are wet or snow covered. The section of Skyline Drive (Forest Development Road #50150) to the west also becomes impassible under these conditions and access must be gained from Forest Development Road #50022 which requires a 48 mile drive to Ferron.

Solitude - With the exception of winter months, the opportunity for solitude is limited due to ease of accessibility, thus primitive recreation opportunities as well as challenging experiences of a wilderness variety are limited.

Special Features - Attractions are limited to aesthetic viewsheds from isolated vista points. Cultural/paleontological values may be present, due to known sites on adjacent lands. However, nothing of significance has been identified within the area itself.

Manageability - Manageability of the area as roadless is low for the area south of Ferron Creek, due to ease of accessibility to and through the unit. It currently receives moderate use during the summer and fall by off road vehicles and during the winter by snowmobiles. North of Ferron Creek, use could be more easily controlled.

Black Mountain

Black Mountain is a 6,580-acre inventoried roadless area identified in the National RARE II analysis. It is located in Sanpete County, Utah (approximately 8 miles southeast of Manti, Utah). Access is via Sixmile Canyon Road (Forest Development Road #50047).

Natural Integrity - Historic and current use, especially ORV use, has altered the area. There are 10.3 miles of road, 2.0 miles of fence, and 2 water developments.

Apparent Naturalness - The area shows little evidence of human presence to a trained observer. Recent slope failures within the area have caused stream channel damage to Sixmile Creek thus impacting community and irrigation water supplies. The lands surrounding the area show the same characteristics, but have had additional use as a result of logging, fuelwood gathering, range improvement, or roads.

Remoteness - Due to proximity to Manti via Sixmile Canyon Road and additional access from Mayfield via the relatively well travelled Forest Development Road #50022, visitors do not gain a measurable sense of "remoteness". The very apparent presence of two-track roads reinforces the lack of seclusive sense.

Solitude - Due to vehicle access and relatively high use levels, opportunities for solitude are limited. Primitive recreation, such as camping, hiking, climbing or cross-country skiing is fair and seeing nature completely undisturbed is non-existent. The level of impact to the landscape is minor and could be restored by closing and seeding the roads, and removing fire pits. Challenging wilderness experiences are also limited.

Special Features - Black Mountain and the aspen basins. Other than these scenic attributes, there are no attractions in the unit. Cultural/paleontological values may be present, due to known sites on adjacent lands. However, nothing of significance has been identified within the area itself.

Manageability - Manageability of the area as roadless is poor, due to the extensive four-wheel drive or primitive roads which exist throughout the area, except on the very steep breaks.

Heliotrope

Heliotrope is a 5,196-acre inventoried roadless area identified in the Forest Plan planning process. It is located in Sanpete County, Utah (approximately 13 miles east of Mayfield, Utah). Access is via Skyline Drive (Forest Development Road #50150) or the Ferron-Mayfield Road (Forest Development Road #50022).

Natural Integrity - There are 4.7 miles of existing road. This area is small in size and has received a relatively large amount of impact from off-road vehicle and livestock use, and consequently was not completely carried through the RARE II process.

Apparent Naturalness - In addition to the typical historic grazing and timber use evident to the trained observer, the lands surrounding this area show much evidence of current mechanized activity.

Remoteness - Due to the proximity of the area to a developed campground at Twelvemile Flat and a very accessible recreation complex at Ferron Reservoir, the area has little remote feeling. Any feeling of seclusion is gained from the dense conifer cover present in the higher elevations of the area.

Solitude - Opportunities for solitude are limited due to the predominate ease of accessibility, which also limits the chance for primitive recreation. Further challenging experiences are almost non-existent outside of off road vehicle travel and snowmobiling.

Special Features - A special feature in this area is a listed threatened plant, Heliotrope milkvetch (*Astragalus montii*). As indicated by Recreation Visitor Day use, there are very limited attractions. Cultural/paleontological values may be present, due to known sites on adjacent lands. However, nothing of significance has been identified within the area itself.

Manageability - Manageability of the unit is very low. Much of the area is accessible via off road vehicles, and it currently receives some off-road use in conjunction with big-game hunting and livestock operations.

Muddy Creek Nelson Mountain

Muddy Creek-Nelson Mountain is a 54,235-acre inventoried roadless area identified in the National RARE II analysis. It is located in Sanpete and Sevier Counties, Utah (approximately 4 miles southwest of Ferron, Utah). Access from Ferron is via Forest Development Roads #50022 and #50043.

Natural Integrity - Coal exploration and development have created many intrusions into the area, as have a range of improvements. The intrusions have cut the area into two parts, the Nelson Mountain top and the upper Muddy. The Muddy drainage below the escarpment has an access road to an old coal mine which reduces the natural integrity to a large extent. The integrity of the rest of the area is diminished by vegetative changes, roads, and range or mineral intrusions. There are 22.6 miles of existing road.

Apparent Naturalness - This area shows some evidence of human disturbance to a trained observer.

Remoteness - This area, in addition to being large, is initially difficult to access. The road through Link Canyon is most suited for four-wheel drive vehicles and is challenging when wet or snow covered. Access from other routes is also difficult during similar conditions. An area to the north west on the mesa lands above the escarpment is closed during part of the year as winter refuge for big game. Stands of Ponderosa pine add to one's feeling of being in a unique place. While hiking through these wooded areas to the precipitous edge of the canyon walls or escarpments a strong sense of isolation is felt.

Solitude - Opportunities for solitude are limited except on Nelson Mountain and in the Muddy Creek drainage. This opportunity for solitude is retained in these areas because of the poor accessibility. Primitive recreation can occur in these areas in the form of challenging hiking, climbing, and camping.

Special Features - The Muddy Creek drainage provides some attractive canyon walls and related canyon features. Nelson Mountain provides a unique vegetative composition, containing several plant associations, and is designated a research natural area. Most of the area's recreation use is based on hunting. Many two-track roads extend down ridges deeply into the area. Historical values may be present in the form of historic mining facilities. Cultural/paleontological values may be present, due to known sites on adjacent lands. However, nothing of significance has been identified within the area itself.

Manageability - Though the area can be difficult to reach; once there, much of the area is highly accessible via off road vehicles. Intrusions have cut the area into two parts, the Nelson Mountain top and the upper Muddy. Nelson Mountain and the area below the escarpments of the Muddy Creek drainage are readily manageable as roadless.

Twelvemile

Twelvemile is a 10,600-acre inventoried roadless area identified in the National RARE II analysis. It is located in Sanpete County, Utah (approximately 6 miles east of Mayfield, Utah). Access is by the Ferron-Mayfield Road (Forest Development Road #50022) and/or the Beaver Creek Road (Forest Development Road #50290).

Natural Integrity - For the most part, the integrity of the area could be restored by rehabilitating man made intrusions. The area shows some evidence of human presence in structural range improvements and two-track roads, of which there are 12.4 miles of roads.

Apparent Naturalness - Historic and current use, as well as acts of nature have altered the appearance of the area so that it may appear to be less than natural. Recent slope failures and mass land movements within the area have caused stream channel damage to Twelvemile Creek and has impacted community and irrigation water supplies. The lands surrounding the area show the same characteristics, and have had additional use in the form of logging, fuelwood gathering, and range improvement.

Remoteness - The rough topography present in the area adds to the visitors sense of remoteness. However, the close proximity to Mayfield and relatively easy access via Forest Development Road #50022 lessens one's sense of isolation.

Solitude - Opportunity for solitude is currently fair due to existing ease of accessibility and consequent use. Access could be restricted and opportunities for solitude improved.

Special Features - Special features include the large landslide which occurred in the spring of 1983. Cultural/paleontological values may be present, due to known sites on adjacent lands. However, nothing of significance has been identified within the area itself.

Manageability - Manageability of the area as roadless is fair, due to the four-wheel drive or primitive roads passing through parts of the area and an indefinite boundary in some places. With some effort in closing roads, and with some boundary changes, manageability could be improved.

White Mountain

White Mountain is a 27,700-acre inventoried roadless area identified in the National RARE II analysis. It is located in Sanpete and Sevier Counties, Utah (approximately 16 miles west of Ferron, Utah). Access is from Skyline Drive (Forest Development Road #50150).

Natural Integrity - Non system roads extend into the area from virtually all directions and it currently receives extensive off road vehicle use, especially in conjunction with big game hunting. There are 8.6 miles of road, 17.5 miles of fence, and 7 water developments.

Apparent Naturalness - The area still shows some evidence of man's presence from typical historic use, to a trained observer. The lands surrounding the area show the same use and much evidence of current mechanized activity.

Remoteness - The area is relatively close to Interstate 70 in Salina Canyon to the south and may be readily accessed from there. There is some sense of isolation at the northern and eastern portions. Due to vegetative openness and topography which allow long views of more developed areas, one does not have a sense of isolation while in the other portions to the south and east.

Solitude - Opportunities for solitude are limited by ease of accessibility. Increased use would further diminish the opportunity for solitude, due to the spacing of vegetative cover. Primitive recreation/challenging experiences are almost non-existent.

Special Features - Special features in this area include a prospective research natural area and a listed threatened plant, Heliotrope milkvetch (*Astragalus montii*). There is an outstanding lookout point on the northern boundary above the Three Lakes area. Cultural/paleontological values may be present, due to known sites on adjacent lands. However, nothing of significance has been identified within the area itself.

Manageability - Manageability of the unit as roadless is very low. The only feature that would facilitate a manageable boundary is the cliff face of White Mountain, which forms half of the northern boundary. The area is easily accessible from improved dirt roads which border it on all sides.

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CHAPTER 4

ENVIRONMENTAL CONSEQUENCES

CHAPTER 4 - ENVIRONMENTAL CONSEQUENCES

4.0 INTRODUCTION

The purpose of Chapter 4 is to disclose the potential environmental effects and consequences that could result from implementation of the alternatives considered in detail described in Chapter 2. The information presented in this chapter forms the scientific and analytical basis for comparison between the alternatives.

The analysis for most resources was limited to the project area. However, in some cases, effects beyond the project area were considered and disclosed.

Impacts to the environment which could result from implementation of the alternatives are discussed in terms of their direct, indirect, and cumulative effects.

Direct and Indirect Effects: Direct and indirect effects are those consequences which are expected to occur immediately following implementation of an alternative. Discussion of direct and indirect effects incorporate past and present actions. Direct effects are caused by the action and occur at the same time and place as the action. Indirect effects are caused by the action and occur later in time or farther from the activity.

Cumulative Effects: Cumulative effects result from the impacts of past, present, and reasonably foreseeable future activities (regardless of what agency or person undertakes such actions) combined with the alternatives considered in this document. This analysis of cumulative effects recognizes that separate activities can combine and interact to provide impacts that are beyond those of individual actions. The disclosure of information in Chapter 3 reflects the cumulative effects of past and present actions up to the current time. Cumulative effects of past, present, and proposed actions are often reflected in the discussion of direct and indirect effects. Additional effects of foreseeable actions are also addressed as cumulative effects.

The methodology used to analyze each alternative was based primarily on the most current mapped resource information. Key map information for each resource was processed in an electronic geographic information system and database. Some mapping analysis was conducted by hand. Effects were analyzed spatially and comparatively. Consideration and disclosure of effects includes past, present, and foreseeable actions within the project area (see Appendix G - Past, Present, and Reasonably Foreseeable Future Actions). The pertinent analysis results are presented in this chapter by resource/issue topic.

This chapter is divided into the following sections:

- 4.0 Introduction
- 4.1 - 4.15 Effects of the Alternatives by Resource/Issue Topic
- 4.16 Relationship to Forest Plan
- 4.17 Potential Conflicts with Plans and Policies of Other Jurisdictions
- 4.18 Probable Environmental Effects that Cannot be Avoided
- 4.19 Relationship between Short-term Use and Long-term Productivity
- 4.20 Irreversible and Irretrievable Commitments of Resources
- 4.21 Other Specifically Required Disclosures

Supporting information developed for the analyses summarized in this chapter is maintained at the Manti-La Sal National Forest Supervisor's Office in Price, Utah.

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4.1 AIR QUALITY

This section of Chapter 4 discusses potential effects to air quality. Effects to air quality are strongly related to the generation of emissions and their dispersal. Reductions in air quality represent a public health concern. The key comparison element for evaluating how the alternatives considered in detail respond to this issue, and their associated effects, is the relationship to State air quality standards.

DIRECT AND INDIRECT EFFECTS

Effects Common to All Alternatives

Although high-intensity (stand-replacement) wildfires are not frequent in the forest types of the area, the abundance of dead trees represents an elevated fire hazard. Additionally, dead spruce trees will continue to fall to the ground and contribute to the accumulation of downed fuel. The presence of dead standing trees, downed fuel, fine fuels, and ladder fuels (fuels such as brush and branches that provide a means for fire from the ground to burn into the tree canopy) increase the probability of more frequent wildfires and wildfires having a high-intensity.

Wildfires inevitably create smoke, a type of emission. Smoke from wildfires is unmanageable, and the severity of air quality degradation is unpredictable. However, the severity of air quality degradation has been modeled to be considerably greater than that of prescribed fire - up to 6 times as much. The actual impact to air quality depends on the time of year the fire occurs, the characteristics of the fuels burned, the duration of the fire, and the resulting amount of smoke created. Wildfires may occur during times of poor dispersion and contribute to regional haze.

The duration of a wildfire could be a couple days or months, depending upon the availability of firefighters and weather conditions. A high-intensity wildfire would be expected to burn until the fuels have been consumed or weather conditions change favorably to help control or extinguish the fire.

Adverse effects to human health from smoke could include eye irritation, throat or lung irritation, shortness in breath, asphyxiation. Extensive exposure to smoke could contribute to emphysema, lung cancer, or heart disease. (USDA Forest Service, 1992a)

Effects of Alternative 1

Since Alternative 1 would not require the use of equipment run on petroleum and would not include fuel reduction through prescribed fire, there would be no direct effects on air quality or associated human health. Indirect effects to air quality could occur if there were a wildfire that could not be promptly suppressed. State air quality standards do not apply to wildfires. Therefore, Alternative 1 would not violate State air quality standards.

Effects of Alternatives 2, 3, and 4

Effects Common to Alternatives 2, 3, and 4

Compliance with the 1988 Memorandum of Understanding (MOU) between the State of Utah Air Conservation Committee and the Forest Service and use of the Manti-La Sal Smoke Management Guidelines for Prescribed Fires (USDA Forest Service, 1992a) would maintain air quality.

All action alternatives would produce emissions from equipment, smoke from prescribed fire, and fugitive dust from roadways and open areas. Given the area's high elevation and wind velocities, the potential for dispersion of emissions is high.

Emissions from Equipment

All action alternatives would generate emissions from equipment run on petroleum products. These emissions would contain pollutants (see Chapter 3 for the components of emissions from internal combustion engines). The concentration of emissions would vary by the type of fuel used, fuel consumption, and the number of motors. Based on the amount of harvest and associated equipment needed to complete that harvest and move the logs to the mill, Alternatives 2 and 3 would generate more engine emissions than Alternative 4. Emission impacts would be localized to the immediate area and time of activity. Because of Federal and State laws regulating emissions, standard equipment requirements, the project's remote location, and high elevation air dispersal, no adverse affects from engine-generated emissions are expected.

Smoke

All action alternatives include prescribed burning of logging slash for site preparation and fuel reduction. To reduce potential effects, a burning plan would be prepared and used in compliance with the MOU which describes the conditions and procedures for prescribed burning, including obtaining approval to burn by the State based on the "Clearing Index".

The amount of smoke produced from prescribed fire depends primarily upon the amount of fuel consumed, method of ignition, and characteristics of the fuel. In the Rocky Mountain Region, burning of logging slash creates 12 pounds of particulates per ton of fuel consumed, 8 pounds of PM-10 particulates per ton of fuel consumed, and 7 pounds of PM-2.5 particulates (CH²M Hill, 1995). Figure 4-1 Prescribed Burning Particulate Emissions, displays hypothetical values for particulate emissions if 30 tons of fuel per acre of logging slash were consumed by fire. Based on the amount of prescribed burning that would occur, representing the amount of fuel consumed, Alternatives 2 and 3 would generate slightly more smoke particulates than Alternative 4.

Figure 4-1 Prescribed Burning Particulate Emissions ¹.

	Emission Factor (lb/ton)	Fuel Consumed (tons/acre)	Area Burned (acres)	Conversion Factor (ton/pounds)	Total Particulates (tons)	Annual ² Particulates (tons)
Alternatives 2 and 3	Total = 12	30	x 3,200 to 4,200	+ 2,000	= 576 to 756	= 96 to 126
	PM-10 = 8	x 30	x 3,200 to 4,200	+ 2,000	= 384 to 504	= 64 to 84
	PM-2.5 = 7	x 30	x 3,200 to 4,200	+ 2,000	= 336 to 441	= 56 to 74
Alternative 4	Total = 12	x 30	x 2,000 to 2,600	+ 2,000	= 360 to 468	= 72 to 94
	PM-10 = 8	x 30	x 2,000 to 2,600	+ 2,000	= 240 to 312	= 48 to 62
	PM-2.5 = 7	x 30	x 2,000 to 2,600	+ 2,000	= 210 to 273	= 42 to 55

¹. Based on emission factor values from CH²M Hill, 1995.

². Modelling treatment of Alternatives 2 and 3 over 5 years, and Alternative 4 over 5 years.

Smoke would be expected in the area of prescribed burning for a duration slightly longer than the ignition time. This could temporarily reduce visibility. A reduced visibility could increase roadway safety concerns as well as reduce one's recreational experience. Nearby recreation areas, such as Ferron and Duck Fork Reservoirs, may be affected.

Impacts would also be expected beyond the area of prescribed burning. The expected trajectory of a smoke plume by type of prescribed fire is: 10 miles downwind from backing fires, 20 miles downwind from head fires, and 30 miles downwind from slash pile burning (USDA Forest Service, 1992a). Correspondingly, towns within these distances may have air quality impacts. The following towns are within an approximate 10-mile radius of the project area: Manti and Sterling. The following towns are within an approximate 10 to 20-mile radius of the project area: Clawson, Ferron, Moore, Freemont Junction, Emery, Salina, Redmond, Axtell, Centerfield, Mayfield, Gunnison, Fayette, Ephraim, and Pigeon Hollow Junction. The following towns are within an approximate 20 to 30-mile radius of the project area: Spring City, Mt Pleasant, Fairview, Hiawatha, Mohrland, Huntington, Lawrence, Orangeville, Castle Dale, Clawson, Molen, Glenwood, Venice, Sigurd, Aurora, Scipio, Levan, Wales, Freedom, Fountain Green, and Moroni. Since winds in the area usually blow from the west to the east, easterly towns have a higher probability of being affected than others.

All action alternatives reduce the risk of large, high-intensity wildfire. The removal of dead trees represents a reduction of material that could otherwise burn and reduce air quality. The prescribed burning of logging slash further reduces the amount of material that could otherwise burn in an uncontrolled setting and reduce air quality.

Dust

Timber operations and road use would likely create dust. Effects would be localized to the immediate area and time of disturbance. Dust may affect one's recreation experience, including visibility. Dust abatement of the native-surface or gravel used roadways would occur by the Timber Sale Purchaser as needed for resource protection or public safety. Additionally if needed, the timing of log hauling could be restricted. There would be negligible difference between the alternatives in the amount of dust expected due to its localized nature, short duration, and potential to abate.

Public Health

Most particulates that would occur as a result of the action alternatives are smaller than PM-10, which is a health concern. This concern is resolved through use of the MOU that ensures prescribed burning would occur only when smoke dispersal is good. In the immediate area of emissions, some individuals may be aggravated by fumes and smoke from the project. Farther from the area, individuals would less affected. In the immediate area of the burning, carbon monoxide is of particular concern. In the Rocky Mountain Region, burning of logging slash creates 74 pounds of carbon monoxide per ton of fuel consumed (CH²M Hill, 1995). However, it dilutes rapidly and should not be a concern downwind (CH²M Hill, 1995).

Effects Differing Between Alternatives 2, 3, and 4

Differences between the action alternatives in regards to potential impact to air quality is not substantial.

CUMULATIVE EFFECTS

Southeast Utah has some of the best remaining clean air in the country (USDA Forest Service, 1992a). This is not expected to change as a result of past, present, and reasonably foreseeable actions.

Compliance with the MOU would ensure that there would be no cumulative effects to air quality from implementation of any of the alternatives.

Cumulative adverse effects to air quality would occur if there were a wildfire.

4.2 LAND STABILITY

This section of Chapter 4 discusses the effects of implementing the alternatives on land stability. Effects to land stability are strongly related to climatic and geologic conditions, soil moisture, and ground disturbance. The key comparison elements for evaluating how the alternatives considered in detail respond to this issue, and their associated effects, are: road construction in unstable and moderately unstable areas; road reconstruction in unstable and moderately unstable areas; and harvest/reforestation in unstable and moderately unstable areas.

DIRECT AND INDIRECT EFFECTS

Effects Common to All Alternatives

The relative risk of landslides occurring naturally in the project area is a function of climatic and geologic conditions. The risk of human activities triggering landslides or accelerating movement on existing landslides is dependent upon changes to existing conditions caused by specific activities or facilities.

If annual precipitation remains near or below average levels, the potential for inducing landslides or for facilities to be damaged by naturally occurring landslides would be minimal. During cycles of above average precipitation, when slopes and associated surface materials become saturated, the risk of inducing landslides or for facilities to be damaged by natural landslides would be considerably higher.

As described in Chapter 3, mortality of spruce trees in the project area is causing a decrease in land stability. If the spruce beetle infestation continues to kill trees as expected, the decreasing number of live spruce could increase landslide potential and frequency. As the trees die, soil moisture is increased because less moisture is absorbed by the trees and evaporated into the air (evapotranspiration). The result is an increase in ground water retained, greater pore pressures, less cohesion, more lubrication, and increased weight which all work to decrease land stability.

Another factor that decreases land stability is the loss of support or buttressing as the tree root systems decay. The loss of soil support or anchoring provided by the tree root systems would also decrease land stability as the root systems decay. Reports by the Forest Service from southeast Alaska (Swanston, 1974) indicate that the number of landslides from harvested areas (live harvest) increases within 3 to 5 years after logging. The results from large areas of tree mortality are expected to be similar. However, root decay rates are probably slower in the project area due to lower precipitation.

With increases in tree mortality, the potential for low magnitude/high frequency landslides (isolated landslides that occur due to changes in localized conditions) would increase. The potential for human activities to trigger landslides could also increase. The potential for low frequency/high magnitude landslide events, which are

attributed to severe regional high precipitation cycles, could also increase slightly. As moisture increases and anchoring by live tree roots decrease, less precipitation is needed to trigger such an event. The recurrence frequency of an event similar to the 1983/1984 flood/landslide event is estimated at approximately 125 years.

The project area contains many existing and ancient landslides. The effects of land instability are common to the area. New landslides and renewed movement of existing landslides would remove vegetation, until it is restored by natural processes, and increase erosion in the landslide area. This could increase sediment production within affected watersheds. Sediment could reach drainages where the landslides extend into them, where vegetation buffers are not adequate to provide an efficient filter, or where topography is such that it routes material toward bodies of water. It is difficult to predict how much sediment production could increase or how much sediment would reach streams.

The area affected by a landslide can range from very localized to several miles downstream within the affected watershed. Damage to facilities and the potential loss of vegetation would usually occur in the immediate area of the landslide, while the effects to water quality from additional sediment production could extend several miles downstream. Landslides generally occur in late winter and spring during wet conditions associated with snowmelt and runoff. Shallow landslides such as rock falls and debris flows occur very rapidly. The area usually becomes stable later in the summer under drier conditions. Deep-seated landslides such as earth flows and complex slides and slumps move more slowly but reach a general state of equilibrium and stabilize during the summer months. Movement can be renewed each spring during wet conditions for many years until the system reaches overall equilibrium.

Landslides could damage existing roads and trails requiring repair and increased maintenance.

Effects of Alternative 1

Continued tree mortality would increase the potential for landslides as described in the preceding "Effects Common To All Alternatives" section. If extensive wildfires occur due to the increase of dry fuels (dead trees), land stability would be decreased. The loss of understory vegetation and remaining live trees (spruce, subalpine fir, and aspen) would compound the decrease in evapotranspiration caused by the insect infestation.

Under this alternative there are no specific plans to replace insect-killed stands by tree planting. Rehabilitation of burned areas would probably be limited to seeding of understory species. It is therefore assumed that reforestation would occur very slowly by natural processes. It is estimated that in well stocked areas (areas with some live immature spruce that survive) approximately 30 years would be needed for tree growth and reforestation to establish evapotranspiration levels similar to those that existed prior to the recent insect infestation. In other areas this recovery would take 30 to 100 years, and some formerly timbered areas would revert to meadows.

Effects of Alternatives 2, 3, and 4

Effects Common to Alternatives 2, 3, and 4

The removal of dead and dying trees would not, in itself, affect land stability. Increases in soil moisture are already occurring due to tree mortality. The decrease in weight or loading on the land (tree surcharge) by removing dead and dying trees is

expected to be a negligible change. Dead and dying trees rapidly decrease in weight by loss of moisture and deterioration.

Changes in evapotranspiration rates as a result of understory vegetation removal from skid roads, new and temporary road construction, and reconstruction of existing roads is also expected to be negligible. Disturbance to understory vegetation is expected to be 15 to 21 percent for ground-based log yarding and 3 to 4 percent for helicopter log yarding (USDA Forest Service, 1980). Ground vegetation would be expected to recover within 3 to 5 years. Areas of prescribed fire would also have temporary reductions in ground vegetation.

Locating log deck areas at the head of existing landslides could load these areas, changing the equilibrium of the landslide and increasing the potential for reactivation. This would be of greater concern during wet conditions in the spring and fall. The potential for inducing new landslides or reactivating existing landslides would be minimized by confining operations to the dry summer months or when the ground is frozen. The potential for log decks and equipment to load the heads of existing landslides and reactivate them is considered to be negligible because existing slides would be avoided and operations would be confined to working in dry conditions or wintertime. Typically the dry field season is July 1st to October 1st. New landslides and renewed movement of existing slides are rare during this time.

Activities that have the greatest potential to decrease land stability include new and temporary road construction, road reconstruction, and staging area development for equipment. These activities would change topography, slope support conditions, and drainage. Accelerated reforestation by planting of spruce under the action alternatives could accelerate reestablishment of evapotranspiration and slope support conditions that existed prior to the insect infestation. The potential for reforestation activity to positively affect land stability would be greatest in areas mapped as unstable and least in areas mapped as stable.

Road construction/reconstruction and staging areas in unstable and moderately unstable areas could induce localized landslides (high frequency/low magnitude), especially on steep slopes and wet areas fed by springs. The increase risk of landslides would remain as long as the changes in natural topography and drainage patterns associated with the roads exist. Reclamation of roads and staging areas (only if returned to approximate original condition) would restore pre-project land stability conditions. Deep cuts and fills on slopes could result in loss of support, loading, and alteration of natural drainage. Fill slopes could become unstable if not adequately drained. The potential for inducing landslides would be minimized by avoiding unstable and moderately areas, slopes greater than 40 percent, and existing landslides where practical. Where these areas cannot be avoided, roads would be designed to minimize changes to topographic and drainage conditions.

The risk of facilities triggering landslides or to be damaged by natural landslides would be high in the areas delineated as unstable. The risk in moderately unstable areas would be moderate. It would be moderate to low in moderately stable areas and low in stable areas. The risk of these facilities to be damaged by natural landslides would be only slightly lower.

Removal of dead and dying trees (dry fuels) could decrease the potential intensity, and size of wildfires. This would in turn decrease the potential for fire-related damage to remaining soil-protecting vegetation and possible resulting landslides.

Effects Differing Between Alternatives 2, 3, and 4

Although there are some differences in the amount of area treated and road work, notable differences in impacts to land stability are not expected between the action alternatives. The extent of area harvested and reforested slightly differs between action alternatives (see Figure 4-2 Activity in Unstable and Moderately Unstable Areas). The amount of road disturbance in unstable and moderately unstable areas slightly differs between action alternatives (see Figure 4-2 Activity in Unstable and Moderately Unstable Areas).

Figure 4-2 Activity in Unstable and Moderately Unstable Areas

	Alternative			
	1	2	3	4
Harvest/Reforestation:				
Harvest/Reforestation in Unstable and Mod. Unstable Areas (acres)	0	3,910	3,910	3,910
Road Work:				
Road Construction in Unstable Areas (miles)	0	0.3	0.0	0.0
Road Reconstruction in Unstable Areas (miles)	0	1.3	1.3	1.3
Total in Unstable Areas (miles)	0	1.6	1.3	1.3
Road Construction in Moderately Unstable Areas (miles)	0	0.9	0.0	0.0
Road Reconstruction in Moderately Unstable Areas (miles)	0	9.1	8.4	8.4
Total in Moderately Unstable Areas (miles)	0	10.0	8.4	8.4

CUMULATIVE EFFECTS

Human activities and alterations to the land since European settlement have had the general cumulative effect of decreasing land stability. Development of a network of roads in areas mapped as unstable and moderately unstable within and adjacent to the project area has increased the potential for landslides. The increased potential is due to changes to natural slope support conditions and drainage.

Overgrazing and extensive human-caused fires in the late 1800's caused extensive decreases in vegetation cover and diversity that have most likely increased the potential for landslides. These changes resulted in increased runoff, severe erosion, and frequent severe flooding and mudflows during the late 1800's and early 1900's (Reynolds, 1911). There is no written information on the occurrence of landslides during this time, but it is assumed that shallow landslides such as debris flows were extensive. This would be the expected outcome of vegetation changes described in early literature and would account for the severe mudflows in the canyons. Intensive management since establishment of the Manti Forest in 1902 and 1903 has resulted in significant increases in vegetation diversity and biomass (USDA Forest Service, 1992c). The decrease in frequency of severe floods and mudflows, especially during the dry summer season, indicates that improved vegetation conditions have decreased the frequency of shallow high frequency/low magnitude landslides such as debris flows, but the potential is probably greater than it was before European settlement. The potential for low frequency/high magnitude landslide events has most likely also increased but to a lesser degree.

Specific projects completed within and adjacent to the project area in the last 15 years are listed in Appendix G. Of these, the projects that could have caused changes to land stability include harvest of live trees and prescribed burns. Additionally, tree planting in salvage harvest areas should accelerate reforestation, therefore, increasing land stability.

4.3 SOILS

This section of Chapter 4 discusses the effects to the soil resource from implementing the alternatives considered in detail. Effects to soil are strongly related to soil type and ground disturbance. The key comparison elements for evaluating how the alternatives considered in detail respond to this issue, and their associated effects, are: estimated amount bare soil by logging method; erosion potential of harvested ground-based yarding areas; amount of road construction and reconstruction.

DIRECT AND INDIRECT EFFECTS

Effects Common to All Alternatives

Any landslides that may occur could have severe impact on the soil resource by displacement, mixing, and increased surface erosion.

Effects of Alternative 1

Under the no action alternative there would be no new soil disturbance from management activities, and the soil would develop in a near-natural setting. Large amounts of woody organic materials from dead and dying trees would be added to the ground surface which would contribute to soil protection and development. Some nutrients would be held in the woody materials until decomposed or released by fire. A potential problem would exist from the fuel buildup that could result in an intense fire which could cause severe soil damage.

The 18 miles of nonsystem roads and nonsystem motorized trails identified for reclamation would continue to exist in a non-vegetative and compacted condition. Soil loss from surface erosion would also continue to persist on these travelways.

Effects of Alternatives 2, 3, and 4

Effects Common to Alternatives 2, 3, and 4

Project design features, including Best Management Practices, would avoid or minimize potential effects to the soil resource.

The action alternatives would result in soil disturbance from the contact of logs and equipment with the land surface. It is estimated that about 15 to 20 percent of the area would have bare soils after ground-based yarding (USDA Forest Service, 1980). Since most of the forested sites have nearly 100 percent ground cover to start with, there would generally be at least 80 percent ground cover after tractor logging. This amount of ground cover would offer adequate soil protection. Additionally, erosion control practices would be used to minimize soil loss. Soil erosion should be minimal.

It is estimated that soil erosion rates would range from about 0.1 to 2.0 tons per acre per year over the ground-based yarding areas, and would decrease over time as vegetation is increased. Although exposing bare soil may increase the soil erosion potential, it may also be beneficial in preparing a seed bed for new vegetation to get started.

Alternatives 2, 3, and 4 include both cable yarding and helicopter yarding. Cable and helicopter yarding would have an estimated increase in bare soil of 3 to 4 percent (USDA Forest Service, 1980). The amount of optional cable yarding is the same for each of these alternatives (115 acres). Cable logging would have a moderate to low impact to soils and could be more impactful than helicopter logging. The little

amount of soil exposure from cable or helicopter yarding would correlate to an insignificant change in soil erosion rates.

Soil compaction would occur on landings, skid trails, and staging areas used for equipment. Areas having severe compaction after use would be scarified to prepare the soil for establishment and growth of planted or natural vegetation.

Burning can have either adverse or beneficial impacts on the soil. Low-intensity fires may benefit the soil and vegetation by releasing nutrients. High-intensity wildfire could eliminate the surface organic cover, reduce microorganisms, burn the soil organic matter, and expose the soil to severe erosion. Controlled burning of slash under the action alternatives would be conducted under prescriptions that would not adversely impact the soil resource.

Temporary road construction and road reconstruction would be required under each action alternative. Soils would be altered along 8 miles of temporary roads and 15 miles of reconstructed roads. This would result in major soil displacement, soil compaction, removal of vegetative production, and localized surface erosion. Temporary road construction would have the same potential negative short term effects on soils as new road construction. Over the long term, temporary roads would return to a vegetative condition and not contribute to soil displacement, compaction, or soil loss. This would allow soils to support vegetation, absorb precipitation, and filter surface erosion. Erosion control measures would be implemented as a part of all new and temporary road construction to minimize soil loss and potential sediment routing into water courses.

All action alternatives propose reclaiming 18 miles of nonsystem roads and nonsystem motorized trails. This would put approximately 1,083 acres back into vegetative productivity and have a positive effect on soil stabilization. Soils in these reclaimed areas, over time, would support vegetation, allow water infiltration, and filter surface erosion.

The risk of soil damage from an intense wildfire would be reduced through the harvest of dead trees (dry fuel).

Effects Differing Between Alternatives 2, 3, and 4

Although there are some differences in the amount of timber harvest and road work, notable differences in effects to the soil resource are not expected between the action alternatives.

Alternative 2 would harvest 1,617 acres using ground-based methods. Alternatives 3 and 4 would harvest 1,067 acres using ground-based methods, 550 acres less than Alternative 2. Figure 4-3 Ground-Based Yarding Soil Erosion Hazard, displays the ground-based yarding acreage in each action alternative by soil map unit and corresponding soil erosion hazard rating for bare soil. Most ground-based activity would occur on soil map units 415, 600, and 700.

As summarized in Figure 4-4 Ground-based Yarding Soil Erosion Hazard Summary, most of the ground-based logging activities would occur on soil map units which have a low to moderate soil erosion potential (99%), and minimal ground-based yarding would occur on soil map units having a high erosion potential (1%). The 13 acres having a high soil erosion hazard rating would occur on soil map units 8 and 45 which have ground-based logging proposed only on slopes that fall in the low end of the slope range, typical for these soil units.

Figure 4-3 Ground-Based Yarding Soil Erosion Hazard

Soil Unit	Soil Erosion Hazard Rating	Alternative 2 (Acres)	Alternative 3 (Acres)	Alternative 4 (Acres)
1	Low	25	25	21
2	Moderate	14	15	13
3	Low	1	1	1
4	Moderate	96	88	76
8	High	10	10	10
45	High	3	3	3
46	Moderate	185	153	132
415	Low	667	477	412
600	Moderate	258	41	180
700	Moderate	368	254	219
Total		1,617	1,067	1,067

Figure 4-4 Ground-Based Yarding Soil Erosion Hazard Summary

Soil Erosion Hazard Rating	Alternative 2		Alternative 3		Alternative 4	
	(Acres)	(Percent)	(Acres)	(Percent)	(Acres)	(Percent)
Low	693	45%	503	47%	434	41%
Moderate	911	56%	551	52%	620	58%
High	13	<1%	13	1%	13	1%

Areas yarded by helicopter would receive very few soil impacts. The acreage of helicopter yarding varies for each action alternative: Alternative 2 would helicopter yard 4,798 acres, Alternative 3 would helicopter yard 5,348 acres, Alternative 4 would helicopter yard 2,792 acres. The high amount of helicopter yarding in Alternative 3 would require the addition of approximately 30 pad sites, these would temporarily take some land out of production until rehabilitated.

Each action alternative would take some lands out of resource production due to road work, see Figure 4-5 Resource Production Reduced by Road Work. New road construction would only occur with Alternative 2. There would be potential long-term effects on sediment routing and permanent loss of soil productivity over 3.5 acres. Temporary road construction and reconstruction would have short-term effects of erosion and sediment routing.

Figure 4-5 Resource Production Reduced by Road Work

ALTERNATIVE	ROAD CONSTRUCTION					
	NEW		TEMPORARY		RECONSTRUCTION	
	(Miles)	(Acres)	(Miles)	(Acres)	(Miles)	(Acres)
Alternative 2	1.1	3.5	8	22	16	44
Alternative 3	0	0	8	22	15	41
Alternative 4	0	0	8	22	15	41

The risk of soil damage from an intense wildfire would be reduced relative to the acreage treated to reduce fuels (harvest, prescribed fire). Alternatives 2 and 3 reduce the amount of dry fuel (dead trees) across 6,530 acres. Alternative 4 reduces the amount of dry fuel (dead trees) across 3,974 acres.

CUMULATIVE EFFECTS

Soil impacts would be added to the projects listed in Appendix G. The total impact would be within Regional soil quality standards (maintaining or improving long-term soil productivity and soil hydrologic function) and soil quality guidelines (restricting areas of detrimental soil disturbance to no more than 15 percent of the activity area, maintaining sufficient ground cover to limit erosion to near natural rates, and maintaining above-ground organic matter to supply and cycle nutrients needed to maintain site productivity).

4.4 WATER RESOURCES

This section of Chapter 4 discusses the effects of implementing the alternatives on the water resources.

WATER QUANTITY

The key comparison element for evaluating how the alternatives considered in detail respond to the sub-issue of water quantity, and their associated effects, is percent increase in mean annual flow.

DIRECT AND INDIRECT EFFECTS

Effects Common to All Alternatives

Water yield will increase as a result of the spruce beetle epidemic. The water yield model used in this analysis predicts an average annual increase of 4.7 inches of water for the areas infected with beetles. The modelled increases in water yield attributable to beetle-caused spruce mortality are presented in Figure 4-6 Modelled Increase of Unmanaged Water Yields.

Figure 4-6 Modelled Increase of Unmanaged Water Yields

WATERSHED	INCREASE AT FOREST BOUNDARY	
	Acre-Feet	Percent Mean Annual Flow
Muddy Creek	860	3
Ferron Creek	860	2
Twelvemile Creek	270	1
Sixmile Creek	360	2
	2,350	2

Muddy Creek gauge accuracy is rated as fair by the US Geologic Survey, which means that the flow measurements are plus or minus 15 percent. Ferron Creek gauge accuracy is rated as poor, which is less than 15 percent. The Twelvemile gauge was discontinued. Six Mile Creek is estimated from the State Hydrologic Atlas. The mean annual flow of Muddy Creek is reported at 28,020 acre feet per year plus or minus 4,203 acre feet per year. The variable 4,203 acre feet per year far exceeds the increase of 860 acre feet shown above for Muddy Creek. The modelled unmanaged water yield increase in Muddy Creek therefore, is not measurable within the precision of the gauge.

The increased flows from the spruce beetle epidemic in seven streams will likely cause channel alterations (bed and bank erosion). When the increases are compared with normal water yield as shown in the Hydrologic Atlas for Utah and assessed on a subwatershed basis, 7 streams will have increased flows of more than 10 percent. These are: Duck Fork and Little Horse Creeks in the Ferron Drainage and Greens Hollow, Mill Fork, Black Fork, Emerald Creek and North Fork of Muddy Creek in the Muddy Creek Drainage. As a rule of thumb, 10 percent is the point

where channel characteristics are likely to change. Research indicates that in some instances less than 10 percent increase in flow has caused channel changes.

The increases in flow will occur because the evapotranspiration rates are reduced as the trees die. The lack of leaves and the openings in the forest allows snow to be blown off of the trees and settle on the ground. The snow piles deeper, takes longer to melt and has less exposure to the wind. This contributes to less sublimation of the snow pack (conversion from snow directly to water vapor). Less water is transpired by the plants. More water infiltrates and then reappears as streamflow. These increases will gradually diminish as the affected areas regenerate. Hydrologic recovery, the return of streamflow to pre-epidemic conditions, will take about 30 years (Potyondy and Stender, 1982; Hibbert, 1979; and Aygar, 1971). Changes in the timing of water yield will result in more water later in the summer due to delayed snowmelt. The peak flows from snowmelt are not expected to be increased.

Untreated areas of dead spruce trees will continue to fall over time and contribute to the downed fuel loading. Although stand-replacement wildfires are not frequent in these forest types, the high mortality of spruce in infested areas increases the probability of more frequent, high-intensity wildfires. Stand-replacement wildfires could compound the adverse effects to water quantity caused by further increasing water yield.

Effects of Alternative 1

Effects expected from Alternative 1 would be the same as those presented in the preceding "Effects Common To All Alternatives" section.

Effects of Alternatives 2, 3, and 4

Effects Common to Alternatives 2, 3, and 4

Models of the logging and road work show negligible changes in water yield. Since roads are narrow, most of the water would be used by adjacent vegetation. Therefore, associated increases would be minimal. Precipitation on the road surfaces would be concentrated in ditches and runoff would increase. The effects logging and road activity have on flooding and total water yield would be negligible.

There would be 4 miles of system roads reclaimed with each action alternative. There would also be 18 miles of nonsystem roads and nonsystem motorized trails reclaimed with each action alternative. This road and trail reclamation would reduce water yield at sites where treatment occurs as a result of improved infiltration from ripping and an increase in vegetative cover. Overall water yield within each watershed would be reduced, but the amount of reduction would not be measurable.

Treated areas (salvage harvest removal of dead trees and fuels reduction) would create a mosaic of openings and fuel breaks throughout the project area, thereby reducing the potential of a high intensity stand-replacement wildfire, and its potential effects.

Effects Differing Between Alternatives 2, 3, and 4

Although there are some differences in the amount of timber harvest and road work between alternatives, notable differences in effects to water yield are not expected.

Alternatives 2 and 3 (logging, landings, and road work) would remove incidental green trees from less than 50 acres with minor increases in water yield. Alternative 4 (logging, landings, and road work) would remove incidental green trees from less than 40 acres with minor increases in water yield.

CUMULATIVE EFFECTS

Several thousand acres of prescribed fires have been identified as past actions. These fires were intended to remove Spruce/Subalpine fir and release aspen as the dominate vegetation on the sites. This change should have a small effect on the water yield for a period of about 5 years. The hydrologic recovery is shorter with aspen than for spruce because the vegetation types are different and the aspen component is expected to quickly occupy site. If salvage timber harvest is implemented, the burn areas should have recovered by then and no cumulative effects would be anticipated.

WATER QUALITY

The key comparison elements for evaluating how the alternatives considered in detail respond to the sub-issue of water quality, and their associated effects, are: surface water sources affected; vegetation disturbed by skid trails, landings, and roads; sediment yield from surface erosion; sediment yield from in-channel erosion; and long-term sediment yield from road reclamation. Discussion of surface water sources affected is contained in the following "Riparian, Wetlands, and Floodplains" section. Discussion of vegetation affected by skid trails, landings, and roads is contained in the preceding "Soils" and "Water Quantity" sections.

DIRECT AND INDIRECT EFFECTS

Effects Common to All Alternatives

The amount of sediment in a stream is the sum of sources from surface erosion, stream channel erosion, and mass movements. Surface erosion is mostly affected by management activities that reduce ground cover. The estimates of existing and changes in sediment yield are based on an early assessment of conditions. Later evaluations found additional existing sediment sources (additional nonsystem road travelways). The effect would be to increase the existing sediment loads and to reduce the percent change as a result of logging. Bed and bank erosion are mostly affected by increased water yield and/or activities that remove vegetation from the riparian areas. Mass movements are primarily related to the geologic conditions and climatic wet cycles.

The Clean Water Act requires that the State of Utah compile a 303(d) list which includes water bodies within the State that do not attain the current water quality standards. The 303(d) list for the project area includes the following streams reaches.

1. San Pitch River and tributaries from mouth to Gunnison Reservoir (which includes Twelvemile Creek). The State of Utah is petitioning the Environmental Protection Agency to remove reference to the tributaries from this designation. Twelvemile Creek would be removed from the designation.
2. San Pitch River and tributaries from Gunnison Reservoir to U32 crossing near Moroni (which includes Sixmile Creek). The State of Utah is petitioning the Environmental Protection Agency to remove the references to the tributaries from this designation. Sixmile Creek would be removed from the designation.

3. Muddy Creek from Highway U-10 to headwaters (which includes Muddy Creek within the National Forest). The data used to make this determination was collected at the Highway U-10 crossing of Muddy Creek, more than 2 miles below the National Forest boundary (Toole, 1995).

The only parameter of concern for the two listings for the San Pitch River is Total Dissolved Solids. The parameters of concern for Muddy Creek include Total Dissolved Solids and Total Suspended Solids (sediment). The State of Utah has no standard for Total Suspended Solids.

Logging and road construction should not affect the parameters of concern in the San Pitch River. Conductivity could be a surrogate for Total Dissolved Solids from logging and road activities.

Changes to Total Suspended Solids (sediment) in Muddy Creek would be small and not measurably affected by the action alternatives. Sediment is likely to be affected by both road construction and timber harvest. The total change in sediment yields, approximately 4 miles downstream from the proposed harvest units, (where the South Fork of Muddy Creek joins the main stem of Muddy Creek), surface erosion attributed to each action alternative is estimated to be less than 2 percent from existing sediment yields. There are some individual smaller subwatersheds that would have up to 11 percent increases in sediment yield as a result of proposed logging activities. Sediment is generated from landslides as well as surface erosion. The Muddy Creek drainage contains many large and small landslides including three active landslides that are continuing to contribute large quantities of sediment to the stream. These landslides tend to further dilute the effects of the project. All of these sources of sediment contribute to the total sediment loads and add to the high values recorded at the data collection site. Rapin (1976) estimated sediment yields in Muddy Creek at the Forest Boundary to be about 168 acre feet per year.

The data collection site that was used to make the 303(d) list determination for Muddy Creek is more than two miles below the National Forest boundary. At this point, the stream has been influenced by channel flow through several miles of the Mancos Shale formation. Streams flowing over the Mancos Shale pick up hundreds of parts per million in Total Dissolved Solids per mile of flow. The sediment yields per square mile also increase greatly.

Due to the large natural variation in sediment loads, the small anticipated changes in sediment would not adversely affect any existing beneficial use of water. Sediment loads in streams from surface erosion could be increased in the Little Horse Creek subwatershed within the Ferron Creek Watershed by about 11 percent in the worst case analyzed. Other streams would have a smaller percentage increase in sediment. These effects would be most intense one to three years after harvest, then would decline over time through natural revegetation (Betchta, 1978). The application of Best Management Practices for erosion and sediment control would reduce potential sediment loads to streams.

The risk of stand-replacement wildfires exists with each alternative. If a large wildfire were to occur, then the effects of increased water yield and stream bank erosion would be compounded. The degree of affect would depend on the amount of runoff until the area is revegetated.

Effects of Alternative 1

The amount of sediment from surface erosion that reaches the streams would be unaffected because the trees are likely to stand for 10 to 20 years. The amount of sediment from channel erosion would be likely to increase, especially in sensitive reaches where fine-grained, unconsolidated, channel materials naturally occur. These reaches would likely show an adjustment in the stream channel shape and configuration.

Under Alternative 1, roads and nonsystem motorized trails would not be reclaimed and would continue to be a source of sedimentation.

With no treatment to break up or reduce fuel loading, the project area and landscape beyond will be at risk of impacts from wildfire. Soils exposed after an intense wildfire could erode and enter adjacent streams.

Effects of Alternatives 2, 3, and 4

Effects Common to Alternatives 2, 3, and 4

Ground-based yarding would create additional runoff from roads, skid roads, and compaction. The additional runoff and erosion of stream banks would be reduced with the use of project design features, including Best Management Practices.

Road reconstruction would occur over 15 miles with each action alternative. Fine sediment production and transport to streams, from existing road surfaces, would slightly decrease as a result of these reconstruction activities. Swift (1984) found that sediment production from road surfaces is considerably less after graveling.

There would be 4 miles of system roads reclaimed with each action alternative. There would also be 18 miles of nonsystem roads and nonsystem motorized trails reclaimed with each action alternative. This road and trail reclamation would reduce sediment yield at sites where treatment occurs as a result of improved infiltration from ripping and an increase vegetative cover. Overall sediment yield within each watershed where reclamation occurs would be reduced, but the amount of reduction would not likely be measurable.

There is some hazard in all action alternatives of accidental spills that could cause water pollution. The hazards remain throughout the life of the project, and increase as the area and number of operations increase. The materials that might be spilled include fuels and other petroleum products. No other chemical pollution is remotely anticipated. The Timber Sale Contract contains provisions to minimize the risk of petroleum product contamination of waters.

The risk of a large wildfire, with potential adverse effects to water quality would be reduced with the action alternatives.

Effects Differing Between Alternatives 2, 3, and 4

Alternative 2

Sediment loads in streams from surface erosion could be increased by a maximum of 11 percent above the existing conditions in Little Horse Creek within the Ferron Creek Watershed. Because of the large natural variation in sediment loads, 11 percent is considered to be non-measurable. The helicopter yarding would add helicopter landing areas and roads as disturbances in addition to the impacts from ground-based logging. Helicopter logging would increase the acres harvested, but the amount of compaction would not change except at the landings. Approximately 1 mile of new road construction and 8 miles of temporary road construction would cause a short term increase in sediment yield. Once the temporary roads are reclaimed, the remaining 1 mile of new roads would not have a measurable effect on sediment yield.

Approximately 6,530 acres of the project area would receive treatment thereby reducing the risk of stand replacement wildfires with associated effects.

Alternative 3

The effects would be slightly less than Alternative 2 due to less tractor logging and no new road construction. Sediment loads on streams from surface erosion could be increased by a maximum of 11 percent from existing conditions in Little Horse Creek within the Ferron Creek Watershed.

Like Alternative 2, approximately 6,530 acres of the project area would receive treatment thereby reducing the risk of stand replacement wildfires with associated effects.

Alternative 4

The effects would be similar to, but less than, Alternative 3 due to the reduced acres of harvest. There would also be fewer helicopter landings with this alternative compared to Alternatives 2 and 3 decreasing the potential for soil compaction, soil erosion, and sediment transport into water courses. Sediment loads on streams from surface erosion could be increased by a maximum of 6 percent from existing conditions in the Mill Fork subwatershed within the Muddy Creek Watershed.

Approximately 3,974 acres of the project area would receive treatment thereby reducing the risk of stand replacement wildfires with associated effects.

CUMULATIVE EFFECTS

Past land management practices have greatly reduced the surface erosion and sediment loading that began with grazing and logging practices of the early 1900's (Rapin, 1976). Continued improvements in grazing practices have resulted in reduced erosion on many areas that had been identified as needing erosion control work and a final determination that erosion is now within acceptable levels (Bare, 1994).

Mill Creek had restoration work that was a part of a larger watershed restoration project (PL-566 Watershed Restoration Project). The work was designed to reduce erosion and sediment yields from the Ferron drainage. The PL-566 project was implemented between 1965 and 1977, with the Mill Creek portion of the project being completed in 1966. The erosion control work completed in Mill Creek has greatly reduced the erosion and sediment loads in Mill Creek and downstream. Alternatives 2, 3, and 4 could add

additional sediment to the stream, but it would not approach the sediment loads prior to the PL-566 project.

The Forest has a program of prescribed fires to change the dominant vegetation from spruce/subalpine fir to aspen. Usually the fires are spotty and the total acres actually burned is relatively small. Cumulative effects of the fires should be minor. Any increases in sediment yield should be negated by expected new sprouting of aspen within 5 years.

**RIPARIAN,
WETLANDS, AND
FLOODPLAINS**

The key comparison elements for evaluating how the alternatives considered in detail respond to the sub-issue of riparian and wetland systems, and their associated effects, are road construction and reconstruction across perennial streams.

DIRECT AND INDIRECT EFFECTS

Effects Common to All Alternatives

There could be a small, temporary (30 years) enlargement of riparian and wetland areas as a result of the water yield increases discussed in the previous "Water Quantity" section.

Although stand replacement wildfires are not frequent events in these forest types, the high mortality of spruce in infested areas would result in increased fire hazard. Stand replacement wildfires could have adverse effects on riparian zones, wetlands, and floodplains. In the short term, the degree of effect would depend on the amount of vegetation destroyed, and whether or not the area is flooded following the fire. Flooding may cause scouring and deposition in the riparian system, which would increase the amount of recovery time.

Effects of Alternative 1

There would be no new road crossings of streams and no new disturbances by roads in riparian areas and wetlands.

As the beetle-killed spruce fall to the ground, they would supply large and small woody debris to the stream that would help in the recovery of the stream system from the impacts of historic overgrazing. The woody debris in the streams helps to support aquatic organisms that are beneficial to the fish. The large woody debris in the streams would help to form step-pool features in the channel, dissipating energy of and reducing erosion by the flowing water. The large woody debris would also help to trap sediment on site and provide a growth media for riparian plants.

Dead spruce trees would continue to fall over time. The amount of large woody debris, in spruce-fir riparian areas is expected to double over the next 5 to 30 years. With no treatment to break up or reduce fuel loading, these areas would be at risk of significant impacts from wildfire.

Under this alternative, roads would not be reclaimed and would continue to be a source of sedimentation.

Effects of Alternatives 2, 3, and 4

Effects Common to Alternatives 2, 3, and 4

The wetlands/riparian/floodplains analysis is based on aerial photo and topographic map interpretations. Additionally, field reviews in 1995 found no wetlands in Unit B4 except around Island Lake, and Unit G4 includes a wet meadow, stream and beaver ponds.

The effects from each alternative to the Riparian Units (RPN) have been evaluated by counting the number of road crossings through riparian zones. Figure 4-7 Road Construction/Reconstruction Across Perennial Streams, shows the differences between the action alternatives in respect to the number of road crossings through riparian zone, floodplains, or wetlands. The road construction and reconstruction crossing perennial streams are displayed in Figures 4-8 and 4-9.

**Figure 4-7 Road Construction/Reconstruction
Across Perennial Streams**

	STREAM CROSSINGS		
	Road Construction	Reconstruction	Total
Alternative 2	9	10	18
Alternative 3	8	8	14
Alternative 4	8	8	14

No tree would be logged from RPNs except at road crossings. This removal of trees and logs could cause an insignificant reduction of the capacity of the RPNs to trap and retain sediment. The removal of trees would reduce the amount of large woody debris that would eventually be recruited into the stream channel for channel formation and fish habitat.

The logging operations, including roads, would cause a small unmeasurable increase in the magnitude of floods. The crossing of riparian areas identified in Figures 4-7, 4-8, and 4-9 would also constitute the crossing of floodplains. The road crossing of streams would constitute a functionally dependent use of floodplains, and the effects would be a permanent loss of riparian vegetation associated with that site.

The project design features require a 100-foot buffer around perennial waters. The project also includes avoidance of wetlands where avoidance is possible, and rehabilitation where avoidance is not possible. The design features that are a part of the alternatives would reduce any permanent effect on wetlands. During each season of operations, there could be some temporary changes to wetlands. The decrease in transpiration and consequent increase in ground water could cause a temporary small increase in the size of wetlands.

The spruce-beetle induced tree mortality and road construction would have the combined effect of reducing shade and increasing the brushy vegetation growing on the site. This which would tend to increase the capacity of the riparian system to trap and retain sediment.

FIGURE 4-8

Stream Crossing Map Alternative 2

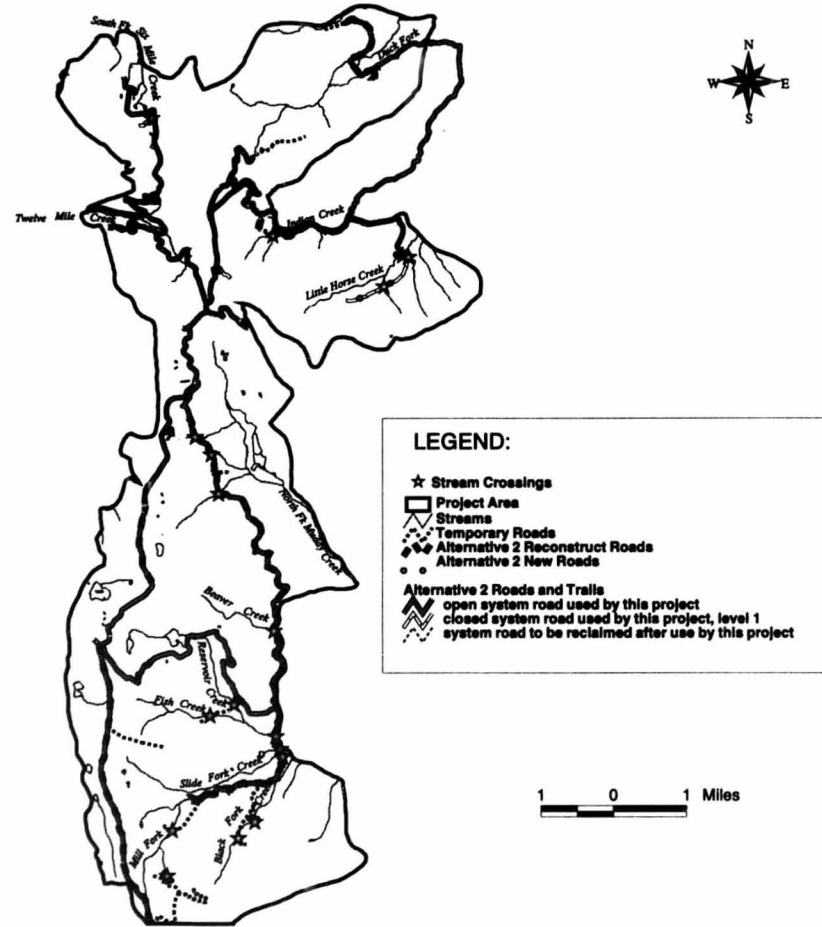
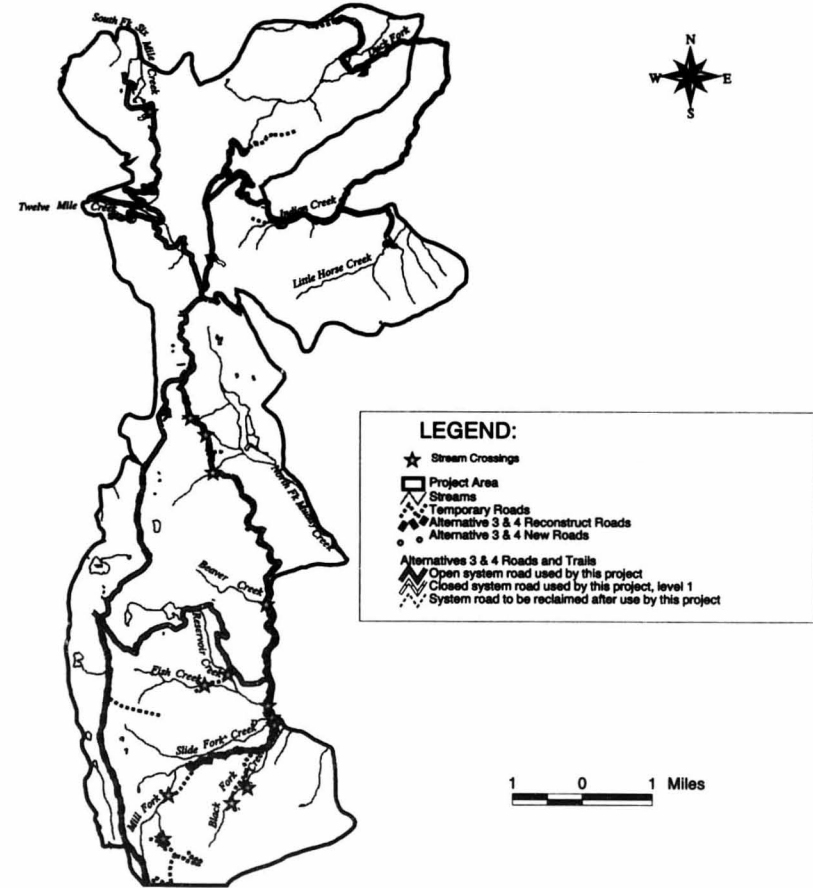


FIGURE 4-9

Stream Crossing Map Alternatives 3 and 4



Effects Differing Between Alternatives 2, 3, and 4

Alternative 2

Figure 4-7 Stream Crossing Map Alternative 2, shows the proposed road construction, temporary road construction, and road reconstruction. There would be 18 occurrences where roads cross RPNs and 2 occurrences where the roads run parallel to the unit without crossing it.

Approximately 6,530 acres across the project area would receive treatment thereby reducing the potential of a stand replacement wildfire and potential resulting loss of riparian vegetation and woody debris.

Alternative 3

Figure 4-8 Stream Crossing Map Alternatives 3 and 4, shows the proposed road construction, temporary road construction, and road reconstruction. There would be 14 occurrences where roads cross RPNs and 3 occurrences where the roads run parallel to the unit without crossing it.

Approximately 6,530 acres across the project area would receive treatment thereby reducing the potential of a stand replacement wildfire and potential resulting loss of riparian vegetation and woody debris.

Alternative 4

The effects to riparian and wetlands would be the same as in Alternative 3 with the same 14 occurrences of RPNs crossings. There are no other differences in the direct effects to riparian and wetlands with this alternative compared to Alternative 3.

Approximately 3,974 acres across the project area would receive treatment thereby reducing the potential of a stand replacement wildfire and potential resulting loss of riparian vegetation and woody debris.

CUMULATIVE EFFECTS

There are no cumulative effects on riparian, wetlands and floodplains when considered with the past, present and reasonably foreseeable future actions listed in Appendix G.

AQUATIC HABITAT

The key comparison element for evaluating how the alternatives considered in detail respond to the sub-issue of aquatic habitat, and their associated effects, is stream habitat impacts from water and sediment yields.

DIRECT AND INDIRECT EFFECTS

Effects Common to All Alternatives

Primary effects of concern when assessing timber treatment projects are increases in water yields, additions of sediment to streams, changes in stream temperatures, introduction of contaminants, and channel degradation that results in loss of important habitat features (e.g. pools, spawning riffles, and bank undercutts). New or improved road access to drainages could also result in fish mortality from anglers and harassment of spawning adult fish. Improper culvert design or placement can interfere or prevent fish passage and isolate subpopulations of aquatic species. Implementation of project design features, riparian protection measures, travel

management, and carefully designed roads and project layout can prevent or reduce all of these effects.

As a result of increased water yields (10 percent or greater increase) following the insect infestation, erosion, channel adjustment, and sediment deposition are predicted in seven streams. All of these drainages support recreational salmonid fisheries, particularly Duck Fork Creek. Increased water yields result in channel down-cutting, increased movement of soils into the stream, and loss of aquatic habitat. Elevated water yield could remove undercut banks, decrease hiding cover, and fill in pools which all contribute to reduction in hiding cover and adult habitat of fish. Increased sediment in streams can affect fish of all life history stages. Sediment in streams can overlay eggs or pre-emergent fry in gravels and can clog gills, all of which can result in direct mortality. As inputs of sediment migrate through the drainages, fish could be temporarily displaced. Fish densities could increase in some areas and decrease in other areas in response to the potential habitat changes discussed above.

Increases in erosion and water yields may also have minor effects on flat-water aquatic habitat. Increased sediments moving through affected drainages are deposited where flows are slow; accelerating the filling in of reservoirs, lakes, ponds, and deposition of sediments on inlet and outlet spawning areas.

Insect-killed trees would provide a temporary increase in large woody debris in perennial stream channels, increased hiding cover, some debris dam-type pools, and an increase in wood-digesting macroinvertebrate communities. Intermittent channels would also experience an increase in large woody debris over the next 5 to 20 years which would help to control channel gradient, slow sediment routing, and potentially reduce fine sediment input to downstream aquatic habitat. Fish densities could increase in response to the potential habitat changes discussed above at localized stream segments where large amounts of dead spruce are expected to increase.

Although stand replacement wildfires are not common events in these forest types, such fires could have temporary adverse effects to aquatic habitat. The primary effects of concern would be sedimentation, introduction of excess nutrients (ash), changes in stream temperature, and channel degradation. Wildfire in riparian zones could also have long-term positive effects on aquatic communities if large woody debris in riparian areas are not consumed. There would be an increase in shrub vigor and grass/forb/sedge riparian vegetation which would provide cover, shade, and filtering of fine sediment. The loss of large woody debris from high intensity fires could have the effect of reducing stream channel stability, decrease macroinvertebrate habitat, and decrease hiding cover for resident fish populations. A long term, steady supply of large wood may not be available after a large scale fire through riparian zones, due to the creation of a uniform age class of new trees that replaces existing stands. Large wood provides food, shelter and pool habitat for aquatic species. The benefits of fire in watersheds could outweigh the temporary negative impacts to water quality and aquatic species habitat only if a high intensity fire, through riparian stands, does not occur and existing large woody debris in the stream and riparian zones are not eliminated.

Effects of Alternative 1

Effects from Alternative 1 would be the same as those presented in the preceding "Effects Common to All Alternatives" section.

Effects of Alternatives 2, 3, and 4

Effects Common to Alternatives 2, 3, and 4

Harvest activity in the watersheds would increase sediment yield, impact channel morphology and affect aquatic habitat; although changes attributable to removal of dead trees would be negligible relative to those resulting from hydrologic effects from the insect infestation. Increased water yield would result in channel down-cutting, changes in stream morphology, temporary filling of pools in some reaches, and possible sedimentation of spawning gravels. The risk and magnitude of these effects would depend on the magnitude of precipitation events during periods of high ground disturbance. In low-water years, little disturbance to aquatic habitat over and above that caused by increased water yields from the insect infestation would be observed. Should a high precipitation event occur (or high runoff) during times of recent ground disturbance, there could be a temporary loss of habitat that would result in decreased fish densities for all life history stages. Declines in filter-feeding macroinvertebrate species would be observed.

All of the action alternatives would result in removal of woody debris, outside of riparian zones, from the watersheds of the project area. Woody debris within stream channels provides essential habitat, nutrients, and food items for aquatic vertebrates and invertebrates. In upland areas, woody debris on slopes intercepts runoff and provides a slow release of nutrients to aquatic ecosystems. Removal of wood from both types of areas can change the character of the watershed, both in terms of nutrient balance and hydrology. The range of natural variability for woody material in Manti Division watersheds and subsequent influences of this material on nutrient balance and hydrology are unknown.

Perennial streams would be protected by a 100-foot "no harvest zone" and "no mechanical entry zone" on perennial channels (RPNs). Intermittent channels would be protected by a 35-foot "no harvest zone" and 50-foot "no mechanical entry zone" along them. These requirements would protect the structure and function of riparian communities and stream channels, most sediment generated from upland erosion would be filtered out. Dead wood from the insect infestation would enter the stream channel and provide increased food, cover, and pools for aquatic species. If these requirements are followed, harvest activities would have no effect on aquatic communities or their habitats (Chamberlin et al. 1991, Belt et al. 1992, Bisson et al. 1987) with the exception of small localized disturbed areas where logging related roads parallel or cross streams.

Best Management Practices provide direction to not conduct gas and diesel fueling activities in riparian zones. There would be no project-caused chemical contamination of soils or water quality and therefore aquatic species would not be affected by such pollutants.

Effects Differing Between Alternatives 2, 3, and 4

Alternative 2

Removal of insect-killed wood from the watershed using ground-based and helicopter/cable harvest techniques would cause small increases in water yield and erosion; but the effects of harvest would be negligible relative to the effects of the increased water yields that will occur naturally. The risk and magnitude of such impacts would increase if a large precipitation event occurs immediately following ground-disturbance.

Implementation of Alternative 2 would require 18 riparian road crossings and 2 road alignments parallel to the stream channel within riparian areas. The soil disturbance and compaction that would result from such construction would cause increased erosion in proximity to these construction sites. Increased erosion would result in temporary filling of pools in some areas and possible sedimentation of spawning gravels, causing some fish displacement and loss of productivity.

Alternative 3

The use of helicopter logging instead of land-based methods would result in less disturbance to the Little Horse watershed than Alternative 2. This alternative would eliminate the need for 2 stream crossings and road construction within Little Horse watershed, thereby preventing the erosion and habitat impacts that can occur with these activities.

Implementation of Alternative 3 would require 14 riparian road crossings and 2 road alignments parallel to the stream channel within riparian areas. The soil disturbance and compaction that would result from such construction would increase soil movement. Increased erosion would result in temporary filling of pools downstream and in proximity to these alignments, and possible sedimentation of spawning gravels.

Alternative 4

This alternative would result in the removal of less woody material from basins in the southern Muddy, Heliotrope, and Sixmile areas and less sediment yield and erosion than Alternative 3. Implementation would require 14 riparian road crossings and 2 road alignments parallel to the stream channel within riparian areas.

All other effects would be less than those projected for Alternatives 2 and 3.

CUMULATIVE EFFECTS

Livestock grazing and wildlife foraging affect all of the drainages within the project area. Both can reduce vegetation cover, vegetation vigor, and result in increased erosion on streambank areas and upland slopes. Both can also result in mechanical damage to bank undercut and channels. All of these effects can contribute to sediment loading and result in aquatic habitat degradation.

Vehicle transportation, including recreation all-terrain vehicles, causes soil compaction, vegetation loss and degradation of riparian areas. Off-road vehicle use (an illegal activity) has impacted riparian areas in the Upper Muddy and Upper Twelvemile drainages (Dufour, 1995). Dispersed recreation sites in Upper Twelvemile, Little Horse Creek, Duck Fork Creek, Upper Muddy Creek, and in proximity to every lake and reservoir in the project area have degraded riparian areas and some aquatic habitats (Dufour, 1995).

Erosion from these cumulative actions increases the amount of sediment moving through aquatic habitats and has subsequent effects on aquatic organisms. Excessive sediment in streams can affect fish of all life history stages. Sediment in streams can overlay eggs or pre-emergent fry in gravels and can clog gills; all of which can result in direct mortality. If habitats become degraded and unsuitable, fish and other aquatic organisms can be temporarily displaced.

Some bank damage, vegetation loss or disturbance, and accelerated erosion exist in the sale area from livestock grazing and wildlife forage use. Existing roads contribute sediments to streams and flat-water habitats.

Dispersed recreation impacts to riparian environments (soil compaction, vegetation loss, increased erosion) is evident in portions of the Upper Muddy, Duck Fork, Little Horse Creek, Twelvemile Creek, and major portions of the shorelines of every lake and reservoir in the project area (Dufour, 1995). All-terrain vehicle crossings are evident in the Twelvemile Basin below Unit G4. Degradation of riparian habitats renders them ineffective at buffering upland run-off and results in increased sedimentation of stream environments. Aquatic organisms, particularly sediment-sensitive species like salmonids, can become temporarily displaced or may experience higher mortality rates and lower reproduction rates.

THREATENED,
ENDANGERED, AND
SENSITIVE AQUATIC
SPECIES

DIRECT AND INDIRECT EFFECTS

Effects Common to All Alternatives

There are no threatened, endangered, or proposed fish species found within the project area. Downstream from the project area, however, there are four Colorado River fish species which are currently listed as endangered: the Colorado squawfish (*Pygocentrus nattereri*), the Bonytail chub (*Gila robusta*), the Humpback chub (*Gila cypha*), and the Razorback sucker (*Xyrauchen texanus*). Primary effects of concern for these fisheries are excessive sediment additions, changes in water temperature, introduction of contaminants, and changes in water quantity.

There are no threatened or endangered amphibian species in the Manti Division of the Forest.

Habitat suitable for supporting the spotted frog (*Rana pretiosa*) (currently classified as a Sensitive species by Region 4 - USFS) is not present within the project area (Perkins, Utah Division of Wildlife Resources Herpetologist; Keleher, Utah Division of Wildlife Resources, 1995 personal communication). Utah Division of Wildlife Resources surveys indicate that spotted frogs prefer lower elevation, floodplain-type environments. Since there are no known populations of spotted frogs in the project area, no effects are anticipated and this species will not be discussed further in this document.

Effects of Alternatives 2, 3, and 4

Effects Common to Alternatives 2, 3, and 4

Project activities would be implemented far upstream from the habitat of Federally-listed Colorado fish species. In the context of the Colorado Basin, the effects of this project would be negligible. The effects on these populations are therefore not discussed for the individual alternatives.

Project riparian protection measures are adequate to protect Colorado River cutthroat trout habitat and populations. Populations would experience negligible habitat degradation over those expected from hydrologic changes resulting from insect infestation. Effects on this subspecies would be the same as described in for aquatic species.

Effects Differing Between Alternatives 2, 3, and 4

Alternative 4 would provide the greatest protection for transplanted populations of Colorado River cutthroat trout in the Little Horse drainage.

CUMULATIVE EFFECTS

Diversion of water for culinary use, agriculture, and hydropower are probably the most important factors affecting the endangered fish species of the Colorado. The timber salvage treatment analyzed in this document would not contribute any measurable effects to these fish or their respective habitats.

Fish habitat would remain at 50%, or better, of potential where self-sustaining fish populations occur. Macroinvertebrate indices would not vary more than 20% from existing condition: Biotic Diversity Index of 11-17, Standing Crop of 1.6 to 4.0, and Biotic Condition Index ≥ 75 .

**4.5 VEGETATION
RESOURCES**

**FOREST HEALTH,
DIVERSITY, AND
PRODUCTIVITY**

This section of Chapter 4 discusses the effects of implementing the alternatives on the vegetation resources.

The key comparison elements for evaluating how the alternatives considered in detail respond to the sub-issue of forest health, diversity, and productivity, and their associated effects, are: dead/dying spruce stands harvested and reforested, and spruce recovery rate in beetle infested spruce stands. Additionally this issue will look at a comparison of stand development and changes in vegetation diversity.

Alternatives were analyzed by use of existing stand inventory data, and the Utah variant of the Forest Vegetation Simulation Model #6.2 (FVS). Detailed analysis information and documentation relative to this issue is available in the project record and in the South Manti Timber Salvage Sales Environmental Assessment and its project record.

DIRECT AND INDIRECT EFFECTS

Effects Common to All Alternatives

The spruce beetle epidemic, although within the natural range of variability for spruce-fir forest types on the Manti-La Sal National Forest, is creating stand conditions more open in structure and less varied than previous to the outbreak.

Stand Development

Stand development or stand production is directly affected by how well the potential growing space in a stand is occupied (stocked).

Since the beginning of the spruce beetle epidemic within the project area, at least 11,275 acres of spruce and spruce-fir stands have experienced extensive mortality of the large-diameter Engelmann spruce. The areas having extreme mortality levels include: the Timber Canyon Timber Sale treated area (330 acres), the Twelvemile Timber Sale treated area (205 acres); the stands considered for treatment in the 1996 South Manti Timber Salvage Sales Environmental Assessment (10,211 acres, including the resulting 2,045 acres approved for treatment from that planning effort; and an additional 272 acres included in the current proposal that were not evaluated for treatment in the 1996 South Manti Timber Salvage Sales Environmental Assessment. Currently, these 11,275 acres are not fully stocked as a result of beetle-induced spruce mortality.

All areas of spruce trees within the project area have experienced, or are experiencing, high levels of spruce tree mortality. Mortality has exceeded 62 percent of the spruce trees in surveyed areas, with an average mortality of 73 percent for all spruce trees greater than 5 inches in diameter at breast height. High levels of spruce tree mortality occurs in the sawtimber size spruce trees (greater than or equal to 8 inches in diameter at breast height). In the spruce trees greater than 11 inches in diameter at breast height, mortality has exceeded 86 percent of the spruce trees in surveyed areas, with an average spruce mortality of 91 percent. In some pure, mature spruce stands mortality of the sawtimber size spruce trees approaches 100 percent. (Anhold and Munson, 1998)

In the project area, epidemic spruce beetle activity has significantly reduced stand development, growth, and production levels from pre-epidemic conditions. The loss of large-diameter spruce will continue in infested areas as long as susceptible hosts and viable spruce beetle populations exist. The spruce beetle-induced mortality has resulted in the natural replacement of the sawtimber size spruce component with shrubs, forbs, grasses, or trees. This replacement occurs as spruce trees die and the openings they leave are filled through foliage and root expansion, natural seeding, sprouting, or artificial planting of trees. Since the created gaps cannot be fully occupied until reforestation occurs through natural regeneration or planting, the spruce mortality has caused extensive reduction in the area fully occupied by growing trees.

The mature, large-diameter live trees that remain as the epidemic passes include subalpine fir, localized clones of aspen, and minor amounts of limber pine, Douglas-fir, and Engelmann spruce.

Approximately 6,285 acres of stands proposed for treatments in the 1996 South Manti Timber Salvage Sales Environmental Assessment are estimated to not be adequately stocked as a result of the spruce beetle epidemic. This figure does not include the Timber Canyon or the Twelvemile timber sales (all of which are considered open and have been planted), or the additional areas identified in this proposal (272 acres of which 139 are classified as open). Total area considered to be poorly stocked as a result of the epidemic is 6,980 acres. Of this poorly stocked area, 5,407 acres are estimated to require reforestation (natural or planted) to return them to a stocked condition in the shortest possible time frame, including the acreage that required planting in the Timber Canyon or the Twelvemile timber sales. Approximately 793 acres have already been planted, leaving 4,614 acres open and requiring reforestation treatments at this time.

Salvage and rehabilitation treatments have been initiated within 2,837 acres of the project area, as previously described above. These treatments include planting of Engelmann spruce seedlings on 793 acres (Timber Canyon and Twelvemile timber sales (566 acres) and 1996 South Manti Salvage Sales (227 acres)).

Approximately 3,021 acres of the 6,530 acres proposed for treatment by this planning effort are considered to be poorly stocked and in need of reforestation treatments at this time.

Within beetle-affected areas where no salvage and reforestation treatments occur (planting or site preparation for natural regeneration), there would be few live dominant or codominant spruce trees equal to or greater than 15-inches in diameter at breast height left in many areas to provide a viable seed source for natural regeneration of spruce (Alexander, 1987). Although spruce and subalpine fir can begin producing cones at heights of 4 to 5 feet, sapling, pole, and small sawtimber size trees are generally poor seed producers. Competition from increased density of

herbaceous plants (shrubs, forbs, and grasses) in effected stands following the epidemic would also limit natural regeneration and growth of tree seedlings (Schmid and Hinds, 1974).

Within beetle-affected areas where no salvage and reforestation treatments occur (planting or site preparation for natural regeneration), 100 to 200 years could be required for many areas to return to pre-epidemic stocking levels. Forest Vegetation Simulator (FVS) modeling done for the 1996 South Manti Timber Salvage Sales Environmental Assessment indicates that areas treated through planting or treatments designed to stimulate natural regeneration could return to normal stocking and production levels 60 to 70 years sooner than untreated stand areas.

Vegetation Diversity

Impact and risk assessment data studies (Munson, 1994), and past and current experience indicate that as a direct result of the spruce beetle epidemic, a majority of the sawtimber-size spruce, including the large, mature spruce trees, in the proposed treatment stands have already died. Most of the residual large green spruce component that is still alive will also die unless the spruce beetle population collapses. This mortality results in: 1) A reduction in genetic diversity; 2) A reduction of the abundance of spruce trees (number); 3) A reduction in diameter, height, and age class diversity (structural); and 4) A reduction in acreage of mature spruce and spruce-fir forest types within the infested area.

Genetic diversity has been reduced throughout the project area by the spruce beetle epidemic. The reduction in genetic diversity is due to the loss of many of the genetic characteristics associated with the large-diameter spruce trees which have been or may be attacked by spruce beetle.

Genetic populations have also been reduced. Some stands or areas of almost pure, large-diameter spruce have experienced, or will experience, almost total mortality of trees within the local ecosystem structure. This results in loss of the mature and more competitive trees (prior to current epidemic) from the genetic pool. Remaining large-diameter spruce are more fragmented and isolated in structure, which could limit interaction of gene pools and increase inbreeding.

From a timber production perspective, the remaining spruce trees may exhibit many undesirable characteristics which could result in lower quality wood and production capability (i.e. slower or reduced height and diameter growth, forking, poor ability to naturally prune limbs, susceptibility to disease and insects, crooking or stem spiral, etc.).

Vegetative species diversity has not changed. Engelmann spruce will remain as a component of the ecosystem. However, the number of spruce trees has been reduced within the infested stands (particularly large-diameter spruce trees). Individual stand conditions vary, but between 70 and 100 percent of sawtimber size (greater than or equal to 8 inches in diameter at breast height) pre-infestation spruce trees have already died in the project area (FHP impact assessment). Mortality continues in recently infested sites where susceptible spruce trees have not been totally depleted.

The dominant forest cover or community type has shifted from a spruce-fir mixed forest to a forest dominated by subalpine fir, see Figure 4-10 Forest Cover Types, Pre- and Post-Beetle Outbreak.

Figure 4-10 Forest Cover Types, Pre- and Post-Beetle Outbreak ¹

FOREST COVER TYPE	PRE-BEETLE OUTBREAK ²		POST-BEETLE OUTBREAK ³	
Spruce-fir	99%	10,396 acres	7%	756 acres
Subalpine fir	0%	0 acres	93%	9,707 acres
Spruce	1%	87 acres	<1%	20 acres

- These figures include acres evaluated in the 1996 South Manti Timber Salvage Sales Environmental Assessment and estimates of conditions on the 272 acres of additional treatment proposed in this analysis.
- Based on inventory prior to the spruce beetle epidemic.
- Based on FVS projections (USDA Forest Service, 1996c).

The dominant forest structure has shifted from multi-storied to open or even-age conditions, see Figure 4-11 Forest Structure, Pre- and Post-Beetle Outbreak. Inventory data indicates that the dominant structure of infested stands was uneven-aged and multi-storied (several age and height classes) prior to the epidemic and up to the time of inventory. Although some uneven-aged conditions will exist following the epidemic and proposed salvage treatment, infested stands have generally shifted towards a more open, even-aged, and single-storied structure as a result of the loss of the overstory spruce component. Exceptions occur in stands and areas where subalpine fir is a major component of the stand structure.

Figure 4-11 Forest Structure, Pre- and Post-Beetle Outbreak ¹

FOREST STRUCTURE	PRE-BEETLE OUTBREAK ²		POST-BEETLE OUTBREAK ³	
Open	17%	988 acres	61%	6,424 acres
Single-Storied	3%	164 acres	5%	518 acres
Multi-Storied	80%	9,331 acres	<34%	3,542 acres

- These figures include acres evaluated in the 1996 South Manti Timber Salvage Sales Environmental Assessment and estimates of conditions on the 272 acres of additional treatment proposed in this analysis.
- Based on inventory prior to the spruce beetle epidemic.
- Based on FVS projections (USDA Forest Service, 1996c).

It is anticipated that many of the dead spruce trees will fall to the ground within 10 to 20 years, creating accumulations of large fuel and woody debris. Studies done by Schmid and Hinds (1974) following spruce beetle outbreaks in Colorado and Utah indicate that 1.3 to 3.0 percent of dead spruce per year fall to the ground following an epidemic. Current salvage and slash treatments over 2,045 acres have reduced the potential for development of stand replacing wildfire in treated stands. These treatments also serve to break the continuity between untreated areas of high fuel concentration, thus reducing the overall risk of stand replacing wildfire within the project area. However, untreated areas would still be at risk of impacts from stand-replacing fire. Adjacent treated stands, although less likely, would be at some risk if stand-replacing wildfire developed in surrounding areas. Once ignited under suitable conditions, a wildfire would burn until either available fuels have been consumed or conditions change to aid in extinguishment. Roads, topography, open rock areas, wet areas, and meadows would help to break the continuity of fuels and limit the subsequent spread of fire through the project area.

Although fire hazards are not usually considered to be a major concern in these forest types, except during periods of drought and high wind conditions (Bradley, Noste, and Fischer, 1992), fire is a natural part of the ecosystem. Evaluations of this area in comparison to properly functioning condition suggest that the spruce-fir forest community should include mixed severity fire regimes on a 50 to 80 year cycle and lethal fire regimes on a 100 to 300 year cycle (USDA Forest Service, 1996b). Fire should contribute to a mosaic of vegetation (size, species, and structure) that encourages patchy fires and prevents the development of large continuous blocks of homogenous ages and species (USDA Forest Service, 1996b). High amounts of spruce tree mortality in stands affected by the epidemic results in increased fire hazards as fuels accumulate. Accumulated fine fuels, ladder fuels (limbs, shrubs, regeneration, etc.), and concentrations of down and standing dead trees increase the risk or probability of localized intense wildfires. As these fuel hazards develop across the landscape, the risk of fires that are both intense and large increases. Events of this nature could further reduce vegetation diversity by destroying remaining live trees and vegetation of all involved species, size, and age classes in affected stands. Stand-replacing wildfires could result in increased soil erosion, reduced soil and site productivity, and reduced mycorrhizae development (mycorrhizae provides an important symbiotic nutritional relationship with coniferous trees), as well as changes in other elements of the ecosystem which effect the growth of trees.

Effects of Alternative 1

Stand Development

Alternative 1 provides for no timber recovery or proactive reforestation activities beyond those activities already approved and disclosed. Effects of implementing Alternative 1 to stand development are the same as those described for non-treatment stands in the preceding "Effects Common to All Alternatives" section. Stand development, growth, and production levels would be reduced. All areas would be left to regenerate naturally, including some aspen sprouting where clones mixed within these predominantly conifer stands receive increased light and reduced competition because of the death of surrounding spruce.

Vegetation Diversity

Alternative 1 provides no management activities to maintain, enhance, or rehabilitate vegetation diversity beyond those activities already approved and disclosed. Effects of implementing Alternative 1 to vegetation diversity are the same as those described for non-treatment stands in the preceding "Effects Common to All Alternatives" section.

Effects of fire hazard as related to vegetation diversity for Alternative 1 are the same as those described in the preceding "Effects Common To All Alternatives" section.

Effects of Alternatives 2, 3, and 4

Effects Common to Alternatives 2, 3, and 4

Stand Development

Non-harvest areas would be left to regenerate naturally under conditions similar to those described in the preceding "Effects Common to All Alternatives" section. Natural regeneration would include sprouting of aspen clones within the untreated stands that are released from the competition and shade of surrounding spruce. Approximately 100 to 200 years could be required for many areas to return to pre-

epidemic stocking levels in the absence of proactive reforestation measures, versus 60 to 70 years sooner on treated areas (based upon 1994 stand inventory and FVS modeling to project future growth and development of stands following treatment in the 1996 South Manti Timber Salvage Sales Environmental Assessment).

Planted areas could require gopher control (underground strychnine baiting) treatments to ensure establishment and continued growth. Treatments would include perimeter treatments around planted areas.

Plantations in areas near drainage bottoms and on slopes may require protection from livestock to ensure seedling establishment and growth for up to 15 years.

Vegetation Diversity

Due to the extent of the spruce mortality throughout the project area and within proposed treatment areas, none of the action alternatives would provide management activities which immediately maintain or enhance vegetation diversity within stands proposed.

The post-epidemic genetic pool would be supplemented through planting of Engelmann spruce trees. This provides some opportunity to select parent trees with desirable traits (diameter growth, height growth, and crown development) from within and around the study area. This would help to reduce inbreeding and selection of less successful trees which survive the epidemic due to their small size or young age. The abundance (numbers) of Engelmann spruce within the project area boundary would be promoted for future management through planting and natural regeneration efforts.

Effects of the action alternatives on forest cover types and stand structure are the same as those described in the preceding "Effects Common to All Alternatives" section. Changes in forest cover types and stand structure have occurred as the result of the loss of live trees and their canopy attributable to spruce beetle induced mortality, not timber harvest.

Planting in the action alternatives would provide the opportunity to return spruce as a component of treated stands in a shorter time than may occur naturally while introducing a new age layer or component within the structure of these stands.

Although the risk of localized wildfires has increased in untreated areas, the overall wildfire hazard would be reduced within the project area through salvage harvest and slash disposal activities. Salvage harvest and slash treatments would reduce fuel accumulations and concentrations, while providing some ground disturbance which would break up the continuity of live and dead fuels. The risk of a stand replacing wildfire to cause further reductions in vegetation diversity or harm other site factors which affect the growth of trees is reduced through salvage harvest and slash disposal activities.

Areas of spruce beetle mortality which are not salvage harvested, would have fuel and fire effects similar to those described in the preceding "Effects Common to All Alternatives" section.

Effects Differing Between Alternatives 2, 3, and 4

Stand Development

Alternatives 2 and 3 allow salvage of dead and dying spruce trees and provides for rehabilitation (reforestation) treatments across 6,530 acres. Alternative 4 allows salvage of dead and dying spruce trees and provides for rehabilitation (reforestation) treatments across 3,974 acres. Alternative 4 would forgo rehabilitation of 2,517 acres that would be harvested and reforested by Alternatives 2 and 3.

Alternatives 2 and 3 would be reforested by planting and natural regeneration across 3,021 acres. Reforestation treatments of Alternatives 2 and 3 include approximately: 1,133 acres of planting, 877 acres of machine site preparation for natural regeneration, and some ground disturbance from harvest and yarding that could promote additional natural regeneration on 1,011 acres. The total natural regeneration for Alternatives 2 and 3 is 1,888 acres. However, the effectiveness of planting and natural regeneration in some areas of Alternative 3 may be less than that of Alternative 2 due to Alternative 3's reduced ground disturbance in areas proposed for helicopter treatments instead of ground-based yarding as in Alternative 2 (736 acres).

Alternative 4 would forgo intensive reforestation efforts on 1,164 acres that would be addressed by Alternatives 2 and 3. Alternative 4 would be reforested by planting and natural regeneration across 1,857 acres. Reforestation treatments of Alternative 4 includes approximately: 696 acres of planting, 539 acres of machine site preparation for natural regeneration, and some ground disturbance from harvest and yarding that could promote additional natural regeneration on 621 acres. The total natural regeneration for Alternative 4 is 1,160 acres.

The reforestation treatments of Alternatives 2 and 3 on approximately 3,021 acres of the 6,530 acres could allow these stands to be brought back to normal stocking and production levels 60 to 70 years sooner than untreated stands (based upon 1994 stand inventory and FVS modeling to project future growth and development of stands following treatment in the 1996 South Manti Timber Salvage Sales Environmental Assessment). The reforestation treatments of Alternative 4 on approximately 1,856 acres of the 6,530 acres could allow these stands to be brought back to normal stocking and production levels 60 to 70 years sooner than untreated stands (based upon 1994 stand inventory and FVS modeling to project future growth and development of stands following treatment in the 1996 South Manti Timber Salvage Sales Environmental Assessment).

If necessary, up to 1,246 acres could be treated for gopher control under Alternatives 2 and 3. Alternative 4 could treat up to 766 acres for gopher control, if necessary.

Up to 11 miles of fence and 340 acres are estimated to require protection from livestock under Alternatives 2 and 3. Alternative 4 is estimated to require protection from livestock for 7 miles of fence and 209 acres.

Vegetation Diversity

Long-term site recovery of treated stands, would vary relative to the amount of planting included in each action alternative. The more acres planted, the greater the recovery would be.

The post-epidemic genetic pool would be beneficially supplemented to varying degrees by the action alternatives relative to the amount of planting included in each. The more acres planted, the greater the contribution to the genetic pool would be.

Future stand character benefits of the action alternatives derived from planting spruce seedlings would be relative to the amount of planting included in each alternative. The more acres planted, the greater the future stand benefits would be.

The opportunity to return spruce as a component of treated stands in a shorter time than may occur naturally, while introducing a new age layer or component within the structure of these stands, would be provided to varying degrees by the action alternatives relative to the amount of planting included in each. The more acres planted, the more areas that would have an accelerated return of spruce stands.

In general, Alternative 2 would provide the highest level of rehabilitation (reforestation) of the action alternatives; Alternative 3 could provide slightly less rehabilitation (reforestation) than Alternative 2 due to its reduced ground disturbance; and Alternative 4 would provide the least rehabilitation (reforestation) based on its reduced amount of treated areas.

Alternatives 2 and 3 would include reforestation activities across 3,021 acres. However, natural reforestation of treated areas within Alternative 3 could be less effective than that of Alternative 2 because it has less ground disturbance. Alternative 4 would include reforestation activities across 1,857 acres, 1,164 acres less than that of Alternatives 2 and 3.

Alternatives 2 and 3 would include planting across 1,133 acres. Alternative 4 would include planting across 696 acres, 437 acres less planting than that of Alternatives 2 and 3. Alternatives 2 and 3 would include natural reforestation across 1,888 acres. Alternative 4 would include planting across 1,160 acres, 728 acres less planting than that of Alternatives 2 and 3.

The overall wildfire hazard reduction within the project area, and potential adverse impacts from a wildfire, would be reduced to varying degrees by the action alternatives relative to the amount of salvage harvest and post-harvest fuel reduction treatments. The removal of dead trees and fuels reduction would create a mosaic of openings and fuel breaks throughout the project area, thereby reducing the potential of a high intensity stand replacement fire. Alternatives 2 and 3 would include salvage harvest and post-harvest fuel reduction treatments across 6,530 acres. Although the treated area of Alternative 3 is the same as that of Alternative 2, the risk of localized wildfires could be slightly higher under implementation of Alternative due to the reduced ground disturbance resulting in more continuous fuels (Alternative 3 includes 736 acres more of helicopter yarding, instead of ground-based yarding than Alternative 2). Alternative 4 provides for 2,517 fewer acres of salvage harvest and post-harvest fuel reduction treatments than provided in Alternatives 2 and 3. Alternative 4 would include salvage harvest and post-harvest fuel reduction treatments across 3,974 acres.

CUMULATIVE EFFECTS

Unless environmental conditions cause spruce beetle populations to collapse naturally, spruce beetles could continue to spread north infesting areas of suitable host type.

NOXIOUS WEEDS

Implementation of Alternative 1 would result in a total recorded harvest since 1979 within the project area of 2,831 acres. Implementation of Alternatives 2 and 3 would result in a total recorded harvest since 1979 within the project area of 9,367 acres. Implementation of Alternative 4 would result in a total recorded harvest since 1979 within the project area of 6,850 acres.

All untreated areas having spruce trees affected by spruce beetle would be subject to natural regeneration through seeding or (where present) clonal sprouting of aspen.

The key comparison elements for evaluating how the alternatives considered in detail respond to the sub-issue of noxious weeds, and their associated effects, is soil disturbance. Noxious weed establishment and invasion is also discussed in this section. Alternatives were additionally analyzed to determine the effect they would have on rangeland vegetation health and productivity.

Information used for the analysis was obtained from long-term records kept at the Ferron Ranger District and information contained in the Manti-La Sal Noxious Weed Environmental Assessment.

DIRECT AND INDIRECT EFFECTS

Effects Common to All Alternatives

Noxious Weeds

Noxious weed populations would continue to be treated in accordance with existing decisions and agreements. Should new populations of noxious weeds be introduced within the project area, the weeds would be treated expeditiously.

Rangeland Vegetation

Forest and area-specific grazing requirements would continue to be implemented across range allotments within the project area.

Effects of Alternative 1

Noxious Weeds

Noxious weeds would continue to spread, but it would be at a lower rate than that of the action alternatives. Weed establishment would come from natural seed dispersal (e.g. wind, wildlife, livestock) and other forest users (e.g. recreationists, hunters).

Rangeland Vegetation

Vegetation trends and production would improve, but it would be over less acres and at a much slower rate than that of the action alternatives. Beetle-induced spruce mortality would change the stand structure and reduce the overstory canopy, increasing the amount of sunlight that reaches the ground. This increased sunlight would allow for natural regeneration of forage species. However, abundant log and wood pilings from dead trees that have fallen to the ground would inhibit establishment of understory vegetation more than that of the action alternatives.

Areas of natural forage production could be at risk from livestock grazing however, heavy downfall would retard use of these areas and the forage could flourish without disturbance.

Effects of Alternatives 2, 3, and 4

Effects Common to Alternatives 2, 3, and 4

Noxious Weeds

Areas of disturbed, exposed mineral soil are conducive to the establishment of noxious weeds. Ground disturbance caused by road work, ground-based and cable yarding, and landing areas would disturb soils and increase the risk of noxious weed spread. All of the action alternatives include these types of activities. Establishment of isolated plants along roads, skid trails, landing areas, and the general area could result in the establishment of an eventual population.

If noxious weeds become established on disturbed sites associated with harvesting before desirable vegetation is established, it is likely other species would not be able to compete with the weeds. This could result in a greater amount of undesirable exotic plant species and less desired plant species. This would be detrimental to the local environment, wildlife, and local economies due to the loss of forage (AUMs), hunters afield, and the cost to treat the weeds.

To minimize the introduction of noxious weeds to the treatment sites, project design features require the Timber Sale Purchaser to furnish proof of weed-free equipment before moving into the treatment unit. Should new populations of noxious weeds be introduced within a sale area, the weeds would be treated under the existing decisions and agreements mentioned above.

Rangeland Vegetation

Vegetative trends and production would improve in localized areas due to an increase in sunlight reaching the forest floor, a lack of competition with conifers, and livestock grazing restrictions. The improvements would take several years due to the lack of a seed bank. Trends would depend on the pre-treatment density of the stand that influence the number and amount of species in the understory.

As new growth occurs, both cattle and sheep would seek it due to its high palatability (depending on the species). However, in the case of cattle, the Forest has seen good establishment of new vegetation following reclamation of gas wells and coal core drilling projects without fencing, and natural establishment following prescribed burning. The Forest has also seen good regeneration success of aspen under sheep grazing following prescribed burning in the Duck Fork area. Yet in some cases, fencing of reforestation areas has been necessary to prevent livestock damage (e.g. Steppe Flats).

The success of understory vegetation regeneration is attributed to rest from grazing the year following treatment and deferred grazing the second year to trample seed into the soil for germination.

Cattle and sheep both seek shade during the heat of the day. This can impact vegetation in bedding areas, but such areas are usually less than 1 acre in size.

Vegetation trends in the surrounding plant communities, suitable to livestock grazing, are trending toward desired condition. It is expected that harvested stands will follow similar trends until the overstory once again limits understory vegetation.

Effects Differing Between Alternatives 2, 3, and 4

No quantifiable differences in effects between the action alternatives would be expected.

CUMULATIVE EFFECTS

Noxious weeds are generally increasing throughout the Forest. Any ground disturbing activity could be conducive to noxious weed invasion and spread. Recreationists and livestock are also likely to be introducing and spreading noxious weeds in the area. If mitigation measures work, the cumulative effects will be nullified.

Vegetative trends in the surrounding plant communities suitable to livestock grazing are trending toward desired conditions. It is expected that harvested stands will follow similar trends until the overstory once again limits understory vegetation.

The key comparison elements for evaluating how the alternatives considered in detail respond to the sub-issue of threatened, endangered, and sensitive terrestrial plant species and their associated effects, are effect and impact determination to such species.

DIRECT AND INDIRECT EFFECTS

Effects Common to All Alternatives

There are no plants within the project area that are proposed for listing, or their habitat.

The threatened Heliotrope milkvetch exists within the project. This plant and its critical habitat is located outside of the proposed treatment units. There would be no effect to this species or its habitat.

No endangered plant species, or their habitat, would be affected by any of the alternatives.

Carrington daisies (*Erigeron carringtonae*), Arizona willow (*Salix arizonica*), Musine groundsel (*Senecio musiniensis*), and Maguire campion (*Silene petersonii*) are sensitive plant species which occur within the project area.

Carrington daisies populations and its habitat areas are not found within the proposed treatment areas. There would be no impact to this species or its habitat.

Arizona willow populations and its habitat are not found within the proposed treatment areas. However, it does occur in riparian habitat adjacent to a Forest Development Road along the potential haul route. Project design features prohibit timber harvest within riparian zones. The project would have no impact on this species or its habitat.

Musine groundsel populations and its habitat are not found within any of the proposed treatment units. However, it does occur in the North Camel and South Camel gravel pits within the project area. A 1997 Biological Evaluation regarding development of these gravel sources determined that Musine groundsel may be impacted (USDA, Forest Service 1997). Since that evaluation was completed, the North Camel gravel source has been exhausted and stockpiled - and would not be used for this project. Mitigations to reduce or eliminate impacts were included as part of the 1997 Biological Evaluation, the applicable mitigations are incorporated into this project as design features regarding use of the South Camel rock pit (USDA, Forest

Service 1997). An additional project design feature prohibiting advancement of the pit to the north would further protect known plant locations. Use of the South Camel Rock pit for this project, and other Forest gravel needs, "may impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or loss of viability to the population or species". This "may impact" determination is based upon, and only applicable to, use of the existing South Camel gravel pit. After crushing activities are complete, there may be a beneficial impact to this species as the resulting loose crushed rock surface provides habitat conducive for establishment of this plant. The present number of plants suggests that it will expand into the new habitat as it seeds itself. Efforts, independent of this project, are also being made to collect seed for distribution. Project activities independent of the South Camel rock pit would have "no impact" to Musinea groundsel.

Maguire campion populations and its habitat are not found within any of the proposed treatment units. However, it does exist within the project area in the exhausted North Camel Rock gravel pit, which would not be used by this project. A 1997 Biological Evaluation regarding development of the North Camel and South Camel gravel sources determined that Maguire campion may be impacted (USDA, Forest Service 1997). Since that evaluation was completed, the North Camel gravel source has been exhausted and would not be used for this project. Mitigations to reduce or eliminate impacts were included as part of the 1997 Biological Evaluation (USDA, Forest Service 1997). The continued use of the stockpiled gravel from this pit for Forest gravel needs "may impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or loss of viability to the population or species". This "may impact" determination is based upon, and only applicable to, use of the gravel stockpiled at the North Camel pit. Project activities independent of the North Camel rock pit would have "no impact" to Maguire campion.

Effects of Alternative 1

Impacts to Musinea groundsel and Maguire campion are associated with the development and use of gravel of the North and South Camel rock pits. Continued use of these pits "may affect" these plants as presented in the preceding "Effects Common to All Alternatives" section. Musinea groundsel and Maguire campion would be expected to continue using existing and created suitable habitat in and surrounding the pits, populations would be expected to increase.

Effects of Alternatives 2, 3, and 4

Effects Common to Alternatives 2, 3, and 4

No quantifiable differences in effects between the action alternatives would be expected.

Effects Differing Between Alternatives 2, 3, and 4

No quantifiable differences in effects between the action alternatives would be expected.

CUMULATIVE EFFECTS

Potential use of the established aggregate sources to support reasonably foreseeable future activities has been considered. For the same reasons presented above, there would be a "may impact" determination for Maguire campion and Musinea groundsel for reasonably foreseeable future activities.

4.6 FUELS/FIRE

This section of Chapter 4 discusses potential effects to fuel loading and fire risk. The key comparison elements for evaluating how the alternatives considered in detail respond to this issue, and their associated effects, are fuel reduction, post-treatment fuel loading, and wildfire potential. Additional discussion of the association between vegetation and wildfire potential is contained in the preceding "Vegetation Resources" section, subsection "Forest Health, Diversity, and Productivity".

The overall effect fuel accumulation would have on the potential for stand-replacement wildfire was assessed by comparing the actual stand appearance to the photo guide for Appraising Downed Woody Fuels in Montana Forests: Lodgepole Pine and Engelmann Spruce-Subalpine Fir Cover Types to assess down and dead fuel loading of each treatment unit (Fisher, 1981). By using the criteria set forth in the photo guide, wildfire potential was assigned to each treatment unit. The actual fuel loading may be higher or lower and the wildfire potential may vary from that of the photo due to differences in elevation, slope, and aspect.

DIRECT AND INDIRECT EFFECTS

Effects Common to All Action Alternatives

It is assumed that an increase of dead and down fuel loads, would increase the potential for stand-replacement wildfire. It is also assumed that a decrease of dead and down fuel loads, or an interruption in the arrangement of the fuels, would decrease the potential for stand-replacement wildfire.

Fire Susceptibility and Stand Structure

The dominant forest cover or community type has shifted from a spruce-fir mixed forest to a forest dominated by subalpine fir. Prior to the spruce beetle epidemic, 99 percent of the forest cover was spruce-fir (10,396 acres). Modelling projections indicate that with the beetle-induced mortality 93 percent of the forest cover would become subalpine fir (9,707 acres). (See Figure 4-10 in the "Vegetation Resources" section, subsection "Forest Health, Diversity, and Productivity".)

Subalpine fir is less resistant than spruce. The subalpine fir stands resulting from spruce beetle activity could be more susceptible to damage and mortality from wildfire than the previous spruce-fir stands.

Subalpine fir is slightly more fire resistant than aspen. Although aspen is susceptible to fire damage, it typically sprouts back and recovers quickly after a fire.

The dominant forest structure has shifted from multi-storied to open or even-age conditions. Prior to the spruce beetle epidemic, the dominant structure of infested stands was uneven-aged and multi-storied with several age and height classes. Approximately 80 percent of the forest structure was multi-storied (9,331 acres). Infested stands have generally shifted towards a more open, even-aged, and single-storied structure as a result of beetle-induced mortality. Modelling predicts that the beetle-caused spruce mortality would leave approximately 34 percent of the stands as multi-storied (3,542 acres). Exceptions would occur in stands and areas where subalpine fir is a major component of the stand structure. (See Figure 4-11 in the "Vegetation Resources" section, subsection "Forest Health, Diversity, and Productivity".)

Multi-storied stands have a high vertical continuity of fuels, often referred to as 'fuel ladders'. Fuel ladders may be represented by 1 or 2 predominant canopy layers or a variety of subordinate vegetation (live or dead) that is horizontally connected or in close proximity to each other. This vertical continuity of fuels creates a potentially high risk of wildfire spreading from the ground into the tree crowns. Fire in tree crowns that are sufficiently closed, or under extreme fire behavior conditions, would likely become crown fires. This high crown fire risk is a key element to the potential for stand-replacement wildfires.

Stands within the project area that are dominated by mature spruce and subalpine fir have significant amounts of fine fuels in the lateral twigs, which when dead, curl against the larger branches or trunk - frequently along the entire length of the tree. Dead trees are often closely intermingled with live vegetation and easily spread fire to the overstory crowns during dry weather. This increased threat of crown fire remains until the dead needles and/or the fine branches fall from the tree.

Additionally, the heavily infested spruce stands will have an understory which is primarily subalpine fir. This understory subalpine fir tends to have low, densely packed crowns. This creates a fuel ladder condition that is conducive to having even low intensity ground fires climbing into the crowns of subalpine fir. Fire in the tree crowns could spot to adjacent dead trees in drought conditions. Consequently, the probability trees torching out and spreading to adjacent stands would be very high. High elevation spruce-fir wildfires primarily spread by fire brands being carried by smoke and/or wind to adjacent stands, creating new fire starts.

Although modelling depicts a general shift to less multi-storied stands, the remaining beetle-affected multi-storied stands would be different than those previously existing. The remaining multi-storied stands would have a greater risk of fire due to the increased amount of standing and down fuel, represented by the dead spruce trees.

Fuel Moisture

Openings that occur in the tree canopy would be expected to have some influence on fuel moisture levels. However, the degree of impact would be relative to the size and extent of openings. In openings, temperature gradients and wind would increase the process of drying the dead, downed fuels. The risk of potential wildfire starts and spread rates would be increased with fuels.

Dead and Down Fuels

For untreated areas, dead and down fuels would increase as a result of beetle-induced spruce tree mortality. Schmid and Frye (1977) reported average fall rates in areas similar to this project to be between 0.7 and 1.5 percent per year with about 84 percent of the trees still standing after about 25 years. It is expected that as beetle-killed trees fall to the ground, large and fine fuels would rapidly accumulate. The average fuel loading of about 30 tons per acre could increase to more than 70 tons per acre. Down material is mainly greater than 3 inches in diameter.

In some cases, dead and down fuel loads already exceed levels necessary to maintain fire line intensities at or below a rate which would allow successful direct suppression efforts.

Effects of Alternative 1

Fire Susceptibility and Stand Structure

Fire susceptibility and stand structure would be affected as described in the preceding "Effects Common to All Alternatives" section.

The potential for stand-replacement wildfire would continue to increase over time. This would result directly from continued increases in down fuel loading as trees killed by the spruce beetle fall to the ground.

Younger trees are more susceptible to fire than the older trees. Areas being regenerated following a beetle epidemic would be set back 20 or more years if fire burned the area (a large percentage of the regeneration and many of the remaining seed trees would be killed).

Fuel Moisture

The locations, rate, and extent of naturally occurring openings within beetle-affected stands is unknown. It is anticipated that it would take longer for stands to naturally open and experience localized dying effects, than it would for treated stands in the action alternatives.

Dead and Down Fuels

Without fuel reduction treatment, the probability of a stand-replacement wildfire would increase. Over time, Alternative 1 would result in the greatest risk of stand-replacement wildfire. This risk would result primarily from continued fuel buildup as trees killed by bark beetle fall to the ground.

As the dead spruce trees fall to the ground, the average fuel loading would more than double (from 30 tons per acre to more than 70 tons per acre). For those areas that could have 70 tons/acre of down and dead woody fuels the fire potential rating would be medium to high, the rate of spread would be high, the fire intensity would be high, the torching would be medium, crowning would be low, resistance to control would be high and the overall fire potential would be high (based on an above average high fire danger of: 85 to 90 degrees Fahrenheit, 15 to 20 percent Relative humidity, 10 to 15 miles per hour winds, and 4 weeks since measurable rain).

Fuels and vegetation are continuous in many areas, with human-made or natural fuel breaks lacking. The current juxtaposition of fuels and vegetation would be expected to remain with Alternative 1, unless a wildfire were to occur and consume some of the fuels and vegetation. The lack of fuel breaks, or other treatment methods to reduce the continuity of fuels, increases the risk of large-scale fire loss.

Effects of Alternatives 2, 3, and 4

Effects Common to Alternatives 2, 3, and 4

Fuel reduction would include: removal of dead trees (timber sales, fuel wood sales, service contracts), piling and burning of logging slash, prescribed burning harvested areas, lopping and scattering of logging slash, and/or fuel break construction around and/or through treated units. Such fuel reduction efforts would reduce the potential of a high-intensity, stand-replacing wildfire.

The post project fuel loading in treated areas would be considerably less than if left untreated. Correspondingly, the reduced fuel loading would represent substantially reduced fire potential, see Figure 4-12 Post-Project Fire Potential.

Figure 4-12 Post-Project Fire Potential

Treatment Areas	Fuel Loading Tons/Acre (Year 1995)	Estimated Fire Potential (Year 1995)	Estimated Fire Potential (Year 2020)	Estimated Fire Potential
			- Without Treatment -	- With Treatment -
D-3	48	HIGH	HIGH	LOW
D-4	48	HIGH	HIGH	LOW
F-3	22 to 48	HIGH	HIGH	LOW
A-9	60	MEDIUM	HIGH	LOW
B-4	40	MEDIUM	HIGH	LOW
C-1	60	MEDIUM	HIGH	LOW
C-3	60	MEDIUM	HIGH	LOW
C-8	49	MEDIUM	HIGH	LOW
D-1	40	MEDIUM	HIGH	LOW
E-1	40	MEDIUM	HIGH	LOW
E-2	33	MEDIUM	HIGH	LOW
D-2	40 to 60	MEDIUM TO LOW	HIGH	LOW
F-1	11 to 51	LOW TO HIGH	MEDIUM TO HIGH	LOW
A-7	11	LOW TO MEDIUM	MEDIUM	LOW
C-2	20 to 34	LOW TO MEDIUM	MEDIUM TO HIGH	LOW
A-1	33	LOW	HIGH	LOW
A-3	32	LOW	HIGH	LOW
A-6	9	LOW	MEDIUM	LOW
A-8	60	LOW	HIGH	LOW
A-11	7 to 9	LOW	MEDIUM	LOW
C-4	70	LOW	HIGH	LOW
E-4	11	LOW	MEDIUM	LOW
C-6	unknown	unknown	unknown	LOW
C-7	unknown	unknown	unknown	LOW
D-5	unknown	unknown	unknown	LOW
E-3	unknown	unknown	unknown	LOW
G-1	unknown	unknown	unknown	LOW
G-2	unknown	unknown	unknown	LOW
G-3	unknown	unknown	unknown	LOW
G-4	unknown	unknown	unknown	LOW
G-5	unknown	unknown	unknown	LOW
G-6	unknown	unknown	unknown	LOW

Fuel Moisture

It is expected that fuel moisture levels would decline due to opening of the canopy through salvage harvest. However, this should only be measurable in the areas with the heavier beetle infestations. Temperature gradients and wind would increase the process of drying the dead, downed fuels more than other areas. Risk of potential wildfire starts and spread rates due to drier fuels would be increased in these more heavily infested areas.

Dead and Down Fuels

As previously discussed, the stand structure is changing due to the high mortality of the spruce component. Studies of dead standing spruce on the White River National Forest have shown that within 20 years after dying, 72 percent of the beetle-killed trees of all sizes were still standing and 28 percent were down. Studies of dead standing spruce on the Dixie National Forest have shown that within 25 years after

dying, 84 percent of the beetle-killed trees of all sizes were still standing and 16 percent were down.

Effects Differing Between Alternatives 2, 3, and 4

Fire Susceptibility and Stand Structure

By salvage harvesting dead spruce trees, Alternatives 2 and 3 would reduce fire susceptibility across approximately 6,530 acres. Alternative 4 would reduce fire susceptibility by salvage across approximately 3,974 acres, 61 percent of that of Alternatives 2 and 3. The alternatives treating a more area would have a greater potential to reduce fire susceptibility. The alternatives treating more area would also have a reduced probability of trees torching and spreading to adjacent stands.

Another difference in the action alternatives that could affect fire susceptibility is the extent of ground-based access into the treatment unit. Alternatives with less ground-based access could have a reduced potential to effectively treat the logging slash. Alternative 2 includes 1,617 acres of ground-based yarding which could be followed with mechanical site preparation. Alternatives 3 and 4 include 1,067 acres of ground-based yarding which could be followed with mechanical site preparation, 66 percent of that of Alternative 2. The reduced ground-based area of Alternatives 3 and 4 is intentional to avoid ground-based equipment impacts to the inventoried roadless areas. The option of using mechanical site preparation in the ground-based yarding areas increases the likelihood of achieving post-harvest fuel objectives.

Dead and Down Fuel Loads

Each action alternative would reduce fuel loadings relative the acreage they would treat, and the extent of the option to use ground-based equipment.

CUMULATIVE EFFECTS

There would continue to be a risk of fire loss in stands within and adjacent to the project area. Untreated areas would be at the greatest risk.

The risk of a large-scale fire spreading through the insect-killed stands within and adjacent to the project area exists. On-the-ground site conditions exist for a fire event that comes about every 100 to 300 years. A fire starting in the project area could easily carry over into adjacent dead stands and burn the residual live trees. If the fire severity is high enough, the fire could then impact and burn adjacent live stands of trees.

Reducing the buildup of activity created fuels by implementing slash disposal mitigations, and breaking up the continuous fuels within stands would reduce the overall wildfire risk.

Past timber sales within, and around, the project area have reduced fuels. Current and future timber management activities in the project area have similar slash disposal requirements and benefits of interrupting fuel continuity.

It is also expected that current grazing practices would continue into the future. These practices would continue to reduce the fine flashy grasses and forbs, contributing to keeping ground fire spread at a low potential. The grazing allotments would also contribute to suppression effort within the project area, by allowing the suppression resources to quickly build and maintain fire breaks.

4.7 WILDLIFE RESOURCES

This section of Chapter 4 discusses the effects of implementing the alternatives on the vegetation resources.

Timber harvest activities impact wildlife species both adversely and favorably by altering their habitat. Impacts to habitat usually comes from two main areas. These are impacts to protective cover and impacts to sources of food. Protective cover can be in the form of vegetative cover or geographic features, and food sources can be vegetation or other species of wildlife. The importance of these will vary from species to species. As a result, one of the best ways to evaluate impacts to wildlife is to analyze impacts to vegetation.

MANAGEMENT INDICATOR SPECIES

The key comparison elements for evaluating how the alternatives considered in detail respond to the sub-issue of management indicator species, and their associated effects are: Elk and Deer - hiding habitat, foraging habitat, vulnerability, and use of available habitat; Blue Grouse - wintering habitat and Douglas-fir stands affected; Golden Eagles - prey base.

The over all effect to wildlife habitat was analyzed by assessing the impacts to Management Indicator Species that are identified in the Forest Plan. These species represent a variety of habitat types and impacts to them can be extrapolated to other species. Additional impacts to sensitive and other wildlife species are discussed following sections.

A. ELK AND DEER

DIRECT AND INDIRECT EFFECTS

Effects Common to All Alternatives

Although individual elk and deer, and their habitat, may be affected, no alternative would contribute to a loss of population viability. Deer and elk would remain an important hunting and viewing resource value for the many recreation visitors of Utah. Beetle-induced spruce mortality and timber harvesting activities have had and will continue to have an adverse impact on big-game, viewing, and hunting opportunities within the project area. As the area becomes reforested and access is managed, these adverse impacts will gradually reduced to pre-infestation conditions. Herds would continue to be managed accordingly by the Utah State Division of Wildlife Resources.

Beetle-induced spruce mortality has increased visibility within timbered spruce/fir areas and reduced hiding cover. Compared to pre-infestation conditions, hiding cover has been reduced about a third within spruce/fir stands not proposed for treatment by the action alternatives and by more than two thirds within the areas proposed for treatment by the action alternatives. Since the area is not used for winter range, the amount of winter (thermal) cover is not relevant.

If a high-intensity wildfire were to occur, wildlife habitat would be substantially altered.

Effects of Alternative 1

Under Alternative 1, the elk herd would probably remain the same and the deer herd should continue to steadily increase.

Alternative 1 would retain the existing hiding cover in the spruce/fir areas affected by the spruce beetle. The character of this cover would continue to change over time. The dead spruce trees currently providing hiding cover would fall to the ground, resulting in a reduced level of cover. Regrowth of shrubs and trees would occur, providing some additional habitat in cover and forage. An indirect adverse effect of no action is the delay of time for regrowth to occur (approximately 10-20 years or longer).

Short-term loss of hiding cover combined with existing hunter and recreation access to the area would increase elk vulnerability and possibly lead to increased hunter success.

Figure 4-13 Big-Game Habitat, displays the miles of open road, open road density, hiding cover/forage acreage and ratio, and habitat effectiveness associated the alternatives.

This alternative leaves an abundance of continuous dead spruce trees with an associated high risk of habitat-altering wildfire.

Figure 4-13 Big-Game Habitat ¹.

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Post-Activity Open Roads (miles)	93	70	70	70
Post-Activity Open Road Density (mi/mi ²)	2.4	1.8	1.8	1.8
Post-Activity Hiding Cover/Forage				
Hiding Cover/Forage (acreage)	12,452/13,619	8,852/17,219	8,852/17,219	10,852/15,959
Hiding Cover/Forage (ratio)	48/52	34/66	34/66	39/61
Habitat Effectiveness (acres)				
Short-Term Reduction from Alternative	0	2,400	2,080	2,080
Cumulative Effects -				
During Harvest	29,760	32,160	1,840	31,840
Post Harvest/Reclamation Efforts	29,760	22,720	22,400	22,400

¹ Overall, the project would improve habitat effectiveness for wildlife in the area by a maximum of 7,400 acres.

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Effects of Alternatives 2, 3, and 4

Effects Common to Alternatives 2, 3, and 4

All action alternatives would directly decrease the amount of hiding cover and indirectly increase the amount of forage. Hiding cover is directly decreased by tree removal within treatment units and by road construction. Forage is increased through the creation of openings and reforestation. Increasing the amount of spring, summer, and fall forage for these species is of minor consequence in this area because this type of habitat is not limiting.

Big-game security is indirectly affected by human access and use of the area. Big-game security would be decreased from improved access, new road access, and noise from logging operations.

Increased utilization of current roads and development of additional roads and their use would reduce habitat effectiveness. Studies have shown that elk use from available habitat is reduced as open road densities increase. Even though the habitat near roads is physically available to elk, it is often not fully utilized. For example, the Lyon model (1979) indicates that elk probably avoid areas adjacent to open roads (with: 1/4 to 1/2 mile) and spent more time in whatever other dense cover they can find.

With the included project design features, effects to elk and deer from wintertime log hauling across the lower elevation winter range would be minimal.

Noise from logging operations could displace elk and deer in the short term. Unlike ground-based logging where noise is relatively localized to the harvest area, the noise from helicopter logging spans a greater area due to the aerial transport of logs from the harvest unit to the landing area. The availability of undisturbed habitat would be continually affected during harvest operations.

Any factor which increased the likelihood of hunters shooting an elk increases elk vulnerability (Moroz, 1991). An increase in disturbance to big-game animals increases displacement and decreases security. During the hunting season, this leads to an increased vulnerability. Timber harvesting activities contribute to increased disturbance, and therefore, vulnerability. To lessen this increased vulnerability, the following design features are included on all action alternatives: all harvest activities are prohibited during the first 9 days and the day before opening day of the general rifle elk hunt; harvest activities may occur during the last 4 days of the general rifle elk hunt; all harvest activities are prohibited during the first 2 days of the general rifle deer hunt, and no hauling the day prior to the season opener. Consequently, effects to elk and deer from decreased security habitat would be reduced. This would not only improve the recreational experience for hunters, but it would also improve hunter safety on the roads and within the project area were harvest activities might otherwise be.

With road reclamation, vulnerability would decrease over time and habitat effectiveness for wildlife would improve by 9,440 acres.

Vegetative conditions in harvested lands would again provide adequate security cover, approximately 30 years following planted reforestation and 40 to 50 years in areas with natural reforestation (Cote, 1995).

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Effects Differing Between Alternatives 2, 3, and 4

Alternative 2

Figure 4-13 Big-Game Habitat, displays the miles of open road, open road density, hiding cover/forage acreages and ratio, and habitat effectiveness associated with the alternatives. In the short term, Alternative 2 would increase the amount of available forage (by 4,200 acres) and decrease the amount of security cover (by 4,200 acres).

Alternative 2 would construct 8 miles of roads. Based on the Lyon study, Alternative 2 represents about 2,400 acres of ineffective security habitat (due to open roads) in the short term. If Alternative 2 is implemented, it is estimated that 10,252 acres of cover vegetation (spruce/fir, conifer/aspen) would remain not harvested.

Habitat disturbance under Alternative 2 would include about 73 percent helicopter yarding and 27 percent ground-based yarding of the 4,200 acre spruce/fir and aspen/conifer types proposed for harvest.

Under Alternative 2, the newly constructed roads (8 miles of new constructed and temporary roads) would be closed to vehicular traffic by the general public during logging operations through closure orders and signing. Post-project activities include reclamation of Forest Development Roads and nonsystem roads totalling 22 miles.

Alternative 3

Figure 4-13 Big-Game Habitat, displays the miles of open road, open road density, hiding cover/forage acreages and ratio, and habitat effectiveness associated with the alternatives.

Habitat disturbance under Alternative 3 would include 82 percent helicopter yarding and 18 percent ground-based yarding of the 4,200 acre spruce/fir and aspen/conifer types proposed for harvest. About 7 miles of new road will be constructed.

In the short term, disturbance here is about the same as Alternative 2 but considerably greater than the Alternative 1. Except for a small difference in habitat effectiveness, Alternative 3 is responsible for 2,080 acres. Effects to deer and elk are approximately the same as Alternative 2. The difference in road construction under Alternative 3 allows for a slight increase in forage and cover opportunities within the analysis area.

Under Alternative 3, the newly constructed roads would be closed to vehicular traffic by the general public during logging operations through closure orders and signing. Post-project activities include reclamation of Forest Development Roads and nonsystem roads totalling 22 miles.

Alternative 4

Figure 4-13 Big-Game Habitat, displays the miles of open road, open road density, hiding cover/forage acreages and ratio, and habitat effectiveness associated with the alternatives.

Habitat disturbance under Alternative 4 would include 70 percent helicopter yarding and 30 percent ground-based yarding of the 2,600 acre spruce/fir and aspen/conifer types proposed for harvest. About 7 miles of new road will be constructed.

Cover/security habitat would be notably greater with this alternative than that of Alternatives 2 and 3. The difference allows vegetative conditions in harvested and unharvested areas to be greater than the other action Alternatives (1,600 acres furnished for security). Habitat effectiveness based on road density would be the same as the Alternative 3.

Under Alternative 4, the newly constructed roads would be closed to vehicular traffic by the general public during logging operations through closure orders and signing. Post-project activities include reclamation of Forest Development Roads and nonsystem roads totalling 22 miles.

B. BLUE GROUSE

DIRECT AND INDIRECT EFFECTS

Effects Common to All Alternatives

Spruce in the project area plays a minor role in winter cover habitat for Blue Grouse. The beetle-induced spruce mortality has rapidly changed the function of the spruce cover type to one of reduced winter habitat. Because of this change, representing a natural depletion of winter habitat, there would be some small impact on the local population of Blue Grouse, but population viability would not be at risk.

Effects of Alternative 1

Since no harvest or harvest-related activities would occur under Alternative 1, no adverse effects would be expected to Blue Grouse. Potential effects, if any, would come from natural succession events.

Effects of Alternatives 2, 3, and 4

Effects Common to Alternatives 2, 3, and 4

Overall, there would be limited impacts to Blue Grouse from implementing an action alternative. Blue Grouse would mostly be affected by each alternative's direct impact to aspen and fir trees. Direct impacts would primarily come from harvest-related activities and road work that inadvertently removes or damages aspen or fir trees. These direct impacts would be short-term (10 to 20 years) and should not cause a noticeable difference in Blue Grouse populations.

The southern part of the project area, including the "D" Units, contain more aspen than the other units proposed for harvest. Activities in this area, would have greater impacts to aspen habitat than activities elsewhere.

Fir species, particularly Douglas-fir, represent a minor component of the project area. The main exception to this is near Julius Flat Reservoir where there is a 105-acre stand of Douglas-fir. The area of this Douglas-fir stand would not be affected by the alternatives.

Effects Differing Between Alternatives 2, 3, and 4

The degree of overall potential impact is relative to the amount of area each alternative would harvest. Alternatives 2 and 3 would harvest 6,530 acres. Alternative 4 would harvest 3,974 acres.

Differing from Alternatives 2 and 3, Alternative 4 would harvest less area in the southern portion of the project area (Unit D-4/5) where the amount of aspen within the spruce/fir stands are higher.

C. GOLDEN EAGLES

DIRECT AND INDIRECT EFFECTS

Effects Common to All Alternatives

Spruce in the project area plays a role in habitat for prey species that eagles forage upon. The change in cover type due to the beetle epidemic has altered the function of the spruce component to one of more open habitat. Because of this change, there would be some small impact on the type of prey species (interior dependant species) eagles forage on. This change would have no overall impact on foraging habitat for eagles because of their opportunistic behavior. Prey species dependant on open forest habitat would become more available for golden eagles.

Effects of Alternative 1

Since no harvest or harvest-related activities would occur under Alternative 1, no adverse effects would be expected to Golden eagles. Potential effects, if any, would come from natural succession events.

Effects of Alternatives 2, 3, and 4

Effects Common to Alternatives 2, 3, and 4

None of the action alternatives should have a noticeable adverse effect on Golden eagles. A Golden eagle could consume a treated gopher, however gopher control would utilize underground methods to prevent eagle and gopher interaction. The most effective and the least likely method to cause damage to wildlife is underground baiting. Underground baiting for gopher control using strychnine presents minimal hazards to nontarget wildlife, either by direct consumption of bait or by eating poisoned gophers (Hygnstrom et. al., 1994). Underground treatment of gophers would occur only where needed.

Effects Differing Between Alternatives 2, 3, and 4

No differences in effects between the action alternatives would be expected.

TREE CAVITY DEPENDANT SPECIES

The key comparison element for evaluating how the alternatives considered in detail respond to the sub-issue of tree cavity dependant species, and their associated effects, is snag habitat affected.

DIRECT AND INDIRECT EFFECTS

Effects Common to All Alternatives

Dead trees (snags) provide tree cavity habitat. All alternatives would continue to provide an abundance of tree cavity habitat in excess of individual tree cavity dependent species needs.

The larger diameter dead spruce trees would be expected to provide tree cavity habitat up to 20 years. The smaller trees would furnish snag habitat up to 10 years (Montgomery, 1998). Spruce tend to be short lived as vertical tree cavity habitat due to their inherently low wind-firmness and eventual rotting of the root systems. However, they would still provide some tree cavity habitat after falling to the ground.

Effects of Alternative 1

There would be 11,490 acres of snag habitat across the project area represented by the spruce/fir and Douglas-fir cover types. This does not include the additional 3,000 acres of live Douglas-fir and aspen stands adjacent to the beetle affected spruce/fir stands. Alternative 1 would have no effects on tree cavity habitat or tree cavity habitat dependant species as no snags or live trees would be harvested.

Effects of Alternatives 2, 3, and 4

Effects Common to Alternatives 2, 3, and 4

All action alternatives would retain a high number of existing snags at varying levels. Adverse impacts to cavity dependant species are not expected.

Within treatment areas, all live non-spruce and dead Douglas-fir trees would not be harvested. Project design features such as snag retention requirements and riparian protection would also add about 350 acres of available tree cavity habitat within the treatment units. The trees not harvested within the treatment units, specifically Douglas-fir, would provide for snag maintenance and recruitment of tree cavity habitat into the future.

Additional snags include several thousand acres of adjacent habitat that would be available within the Douglas-fir and aspen sites where no harvest would occur.

Effects Differing Between Alternatives 2, 3, and 4

Figure 4-14 Snag Habitat Affected, displays the how each action alternative affects snag habitat.

Figure 4-14 Snag Habitat Affected¹.

	Alternative 2	Alternative 3	Alternative 4
Spruce/fir Tree Cavity Habitat Affected			
Acres	4,200	4,200	2,600
Percent	37%	37%	23%
Spruce/fir Available Not Affected			
Acres	7,290	7,290	8,890
Percent	63%	63%	77%

¹. Based on about 11,490 acres of spruce/fir habitat (No Action).

**PROPOSED,
THREATENED, AND
ENDANGERED
SPECIES**

The key comparison elements for evaluating how the alternatives considered in detail respond to the sub-issue of proposed threatened, and endangered species, their associated effects, is the effect determination to such species.

The project area contains habitat for the following listed species: Canada Lynx (proposed), bald eagle (threatened), peregrine falcon (endangered), and Southwest willow flycatcher. Refer to Appendix J - Biological Assessment, for additional information.

DIRECT AND INDIRECT EFFECTS

Effects Common to All Alternatives

There would be "no effect" to peregrine falcon (endangered) from implementation of any of the alternatives.

There would be "no effect" to Southwest willow flycatcher (endangered) from implementation of any of the alternatives.

Effects of Alternative 1

Alternative 1 would have "no effect" to the proposed and listed species: Canada lynx (proposed), bald eagle (threatened), peregrine falcon (endangered), and Southwest willow flycatcher (endangered).

Effects of Alternatives 2, 3, and 4

Effects Common to Alternatives 2, 3, and 4

The action alternatives "may affect individuals or habitat, but will not likely contribute to a trend towards Federal listing or loss of viability to the population or species" of Canada lynx (proposed). Adverse habitat impacts from the action alternatives would be as a result of increased human activities in winter habitat. However, there has not been a sighting of lynx in this area since the 1950's. Beneficial habitat impacts from the action alternatives would occur from reforestation.

The action alternatives "may affect individuals or habitat, but will not likely contribute to a trend towards Federal listing or loss of viability to the population or species" of bald eagle (threatened). Impacts from the action alternatives include possible disturbance from helicopter activity during eagle migration through the area.

There would be "no effect" to peregrine falcon (endangered) from implementation of any of the alternatives.

There would be "no effect" to Southwest willow flycatcher (endangered) from implementation of any of the alternatives.

Effects Differing Between Alternatives 2, 3, and 4

No differences in effects between the action alternatives would be expected.

SENSITIVE SPECIES

The key comparison elements for evaluating how the alternatives considered in detail respond to the sub-issue of sensitive animal species and their associated effects, is the impact determination to such species.

The project area contains habitat for the following sensitive species: Northern goshawk, flammulated owl, three-toed woodpecker, spotted bat, and Townsend's big-eared bat.

A. NORTHERN GOSHAWK

DIRECT AND INDIRECT EFFECTS

Effects Common to All Alternatives

Long-term impacts could occur from natural succession as the conifer species begin to out compete and convert the current suitable habitat (conifer/aspen mix) to pure conifer (15-25 years).

Effects of Alternative 1

Alternative 1 would have no direct or indirect impact on Northern Goshawk from harvest activity. Within the conifer/aspen forests, impacts could come from the natural loss of the spruce overstory layer needed for nesting purposes and from conifer species out competing the current suitable nesting habitat of conifer/aspen.

Effects of Alternatives 2, 3, and 4

Effects Common to Alternatives 2, 3, and 4

The action alternatives may impact habitat, but will not likely contribute to a trend to Federal listing or loss of viability to the population or species. The project design features would adequately provide for the needs of Northern Goshawk.

Timber harvest has an indirect impact to prey species used by the goshawk. Goshawks in the area are known to prey primarily on snowshoe hare and flickers. Timber harvest would increase populations of some prey species (especially small mammals) and decrease populations of others (such as woodpeckers). Therefore, it is likely that impacts to prey species would not make much difference in the overall availability to prey. In the long term, natural succession accelerated by the spruce beetle also has an indirect impact to prey species. Like timber harvesting, a change in prey due to the loss of the overstory habitat would occur but over a longer time frame.

The direct project impacts to goshawk habitat is short-term relative to the amount of harvest within suitable nesting habitat. However, implementation of the Conservation Strategy and Agreement for the Management of Northern Goshawk Habitat in Utah (Utah N.F.'s, et. al., 1998; Graham, 1998) is incorporated into the project design features to allow for conserving and protecting the Northern Goshawk and its habitat.

Effects Differing Between Alternatives 2, 3, and 4

Each action alternative would affect suitable goshawk nesting habitat to varying degrees (see Figure 4-15 Project Activity within Suitable Nesting Habitat). The degree of impact is relative to the amount of harvest within suitable goshawk nesting habitat.

Figure 4-15 Project Activity within Suitable Nesting Habitat

	Alternative 2	Alternative 3	Alternative 4
Project Activity within Suitable Nesting Habitat (acres)	1,164	1,083	795

B. FLAMMULATED OWL

DIRECT AND INDIRECT EFFECTS

Effects Common to All Alternatives

There are no effects expected to be common to all alternatives.

Effects of Alternative 1

Alternative 1 should have no impacts on the flammulated owl. All Douglas-fir stands would be maintained within the project area.

Effects of Alternatives 2, 3, and 4

Effects Common to Alternatives 2, 3, and 4

The timber harvest may impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or loss of viability to the population or species within the area. Flammulated owl prefer foraging in areas with open canopies and have been known to avoid cut-over areas. Therefore, the more acres cut, the greater the potential for adverse impacts (the more foraging area impacted).

Impacts to flammulated owl nesting habitat could occur in spruce stands containing Douglas-fir located along ridge-tops and upper slopes.

Harvesting large-diameter snags of any species in these areas could impact nesting habitat. However, the only stand of Douglas-fir is located near Julius Flat Reservoir in the southern portion of the project area. None of the Alternatives allow the harvest of Douglas-fir. One of the project design features common to all action alternatives is for the retention of all large snags containing cavities and to retain small pockets of dense vegetation along ridge tops. This would reduce any possible adverse impacts to flammulated owl nesting habitat (refer to the previous discussion of tree cavity habitat).

Effects Differing Between Alternatives 2, 3, and 4

Alternative 2 and 3

Alternatives 2 and 3 would allow harvesting on 4,200 acres. This potentially could be the greatest impact (highest acreage of all action alternatives) on flammulated owls because they may avoid the area due to harvested cuts. Snag retention levels and residual fir trees during harvest could influence current and future nesting and cover habitat. Within the cutting units, there would be riparian protection trees, designated wildlife spruce snags, and residual fir trees that would provide habitat for wildlife. Outside of cutting units, 71 percent of additional large snag and live fir habitat would be available.

Alternative 4

Alternative 4 would allow harvesting on 2,600 acres. This potentially could be the least impact (least acreage of all action alternatives) on flammulated owls because avoidance of harvested areas would be less. Snag retention levels and residual fir trees could influence current and future nesting and cover habitat. Within the cutting units, there would be riparian protection trees, designated wildlife spruce snags, and residual fir trees that would provide habitat for wildlife. Outside of cutting units, 82 percent of additional large snag and live fir habitat would be available.

C. THREE-TOED WOODPECKER

DIRECT AND INDIRECT EFFECTS

Effects Common to All Alternatives

Three-toed woodpeckers specialize in finding and capitalizing on available dead trees, especially those infested with the spruce beetle. It would be expected that three-toed woodpeckers would follow the general movement of a beetle infestation. Beetle activity in moving north of the project area. An increase in population would be expected as their territory of available food is expanded. Eventually, as prey species (spruce beetle) decline, the density of this woodpecker would decrease (Koplin, 1968). Once prey species have declined, three-toed woodpeckers should continue to inhabit the area but at lower population densities. Studies indicate that the three-toed woodpecker will resume feasting on windthrown trees and cull logs where beetles will continue to infest, but at much lower levels. The resulting infestations in down logs are often a major source of mature beetles that perpetuate local populations for three-toed woodpeckers (Baldwin, 1968).

Effects of Alternative 1

In the short-term, Alternative 1 would not influence the current condition for three-toed woodpeckers. There would be 11,500 acres (within the pure conifer stands) of snag habitat across the project area. This does not include an additional 3,000 acres of live fir and aspen adjacent to the dead spruce.

Effects of Alternatives 2, 3, and 4

Effects Common to Alternatives 2, 3, and 4

The timber harvest may impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or loss of viability to the population or species within the area. Removal of the beetle-killed trees directly reduces the specialized habitat. Therefore, the impacts of the harvest alternatives are directly associated with the amount of harvest that occurs or the amount of dead trees removed from availability.

All action alternatives would retain enough snags within the harvest units (probably greater than 8 per acre) to allow three-toed woodpeckers use within the units. Besides exceeding Forest Plan of 0.9 snag per acre, additional snags include uncut Douglas-fir, about 350 acres of protected riparian buffer areas, and residual spruce snags for wildlife. The alternatives that harvest three-toed woodpecker habitat would leave 71 to 82 percent of the total spruce/fir area. Additional acres adjacent to these stands would include aspen (2,857 acres) and Douglas-fir (105 acres) where no harvesting would occur.

Effects Differing Between Alternatives 2, 3, and 4

Figure 4-16 Three-Toed Woodpecker Habitat Affected, shows the amount of proposed for each of the alternatives and the percentage of beetle-created habitat that would be affected.

Figure 4-16 Three-Toed Woodpecker Habitat Affected¹

Habitat Affected	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Acres	0	4,200	4,200	2,600
Percent	0	29%	29%	18%

¹ Based on about 14,200 of current habitat acres.

Of the action alternatives, Alternatives 2 and 3 harvest activities the most three-toed woodpecker habitat (4,200 acres). Because of this, they would have the greatest impact on three-toed woodpeckers.

Of the action Alternatives, Alternative 4 would harvest activities on the least amount of three-toed woodpecker habitat (2,600 acres). Because of this, it would have the least impact of the action alternatives on Three-toed Woodpeckers.

D. SPOTTED BAT & TOWNSEND'S BIG-EARED BAT

DIRECT AND INDIRECT EFFECTS

Effects Common to All Alternatives

Spotted and Townsend's big-eared bats would continue to forage mostly along forest edges and over water. Over time, forest edge within the spruce/fir would continue to deplete resulting in less edge habitat for the bats. It is possible surface water (small ponds, springs, seeps) areas would increase because of the loss of the large water pumping spruce trees.

Effects of Alternative 1

Roosting areas would not be affected by this Alternative, however it is possible that other non-project activities could disturb potential roosting areas (limestone cliffs) such as using the Camel Rock quarry sources for road gravel.

Effects of Alternatives 2, 3, and 4

Effects Common to Alternatives 2, 3, and 4

The timber harvest may impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or loss of viability to the population or species within the area. Spotted and Townsend's big-eared bats would continue to forage mostly along forest edges and over water. Mainly because bats forage at night and not in stands of timber harvest, activities should not impact bat foraging. Both of these bats are known to use limestone cliffs for roosting. Timber harvesting activities that impact limestone cliffs, such as quarry sites for road gravel, could impact these species. The only quarry site adjacent to cliffs is the Camel Rock quarry. Effects to the bats regarding potential occurrence relative to the rock quarry activities have been analyzed and mitigation measures have been implemented to address possible impacts. Findings indicated there were no bats roosting in the area. However, a

"May Impact" finding was disclosed due to the proximity of habitat within the rock quarry sites (refer to the Camel Rock Quarry Biological Evaluation, 1997).

Effects Differing Between Alternatives 2, 3, and 4

No unique impacts between action alternatives would be expected to spotted and Townsend's big-eared bats.

NEOTROPICAL MIGRATORY BIRDS

DIRECT AND INDIRECT EFFECTS

Effects Common to All Alternatives

All impacts (positive and negative) to Neotropical migratory birds would occur due to natural forest events. Declines in population sizes have been partially due to habitat loss from fragmentation and introduced edge habitat which has reduced the amount of interior habitat.

None of the alternatives should threaten the population viability of such species. The spruce cover type has and is continuing to rapidly evolve from a closed overstory to more of an open overstory. This change should benefit those species dependant upon more open forest settings and negatively impact those species dependant upon a closed, interior forest setting.

Effects of Alternative 1

Alternative 1 would have no unique impacts to Neotropical migratory birds.

Effects of Alternatives 2, 3, and 4

Effects Common to Alternatives 2, 3, and 4

Harvesting dead spruce trees would not increase fragmentation or edge, or reduce interior forest habitat since the beetle infestation already set back the successional stage to one of an open character. Therefore, no effects are expected to Neotropical migrant birds from fragmentation, edge, or reduced interior forest habitat.

Timber harvest has the potential to affect species reliant on snags or blown down trees for a portion of their habitat (refer to the previous discussion of tree cavity habitat).

Other minor effects could include potential direct impacts to nest sites and/or habitat for prey species due to the creation of skid trails, log landings and incidental disturbances to adjacent fir trees.

Effects Differing Between Alternatives 2, 3, and 4

No unique impacts between action alternatives would be expected to Neotropical migratory birds.

CUMULATIVE EFFECTS

Management Indicator Species

The biggest forest activity that has recently influenced cover and forage within the conifer/aspen habitat is prescribed burning. Prescribed burning (for aspen regeneration) has taken place, and presently continues to play an important management role within and adjacent to the project area. Past prescribed burns have included about 6,660 acres with about 65 percent of these acres directly influencing the vegetation. Since the burns have occurred (5 to 9 years ago), it is estimated about 90 percent of the treated areas now provide primarily cover and forage habitat. Therefore, these past burns do not change the overall cover and forage ratios described above. About another 3,150 acres of vegetation is planned to be burned near Ferron Reservoir (the Jungle Burn) and Sixmile. It is anticipated about 65 percent of these acres (2,045) would also directly influence the vegetation. In the short term, cover habitat would decrease and forage habitat would increase (about 90 percent (1,837 acres) within 1 to 5 years).

Figure 4-17 Hiding Cover/Forage % Ratio, describes cumulative effects of past, present, and proposed harvest activities and prescribed burning. These activities have been incorporated cumulatively into the cover/forage ratio analysis for big-game. Because of the loss of cover, the planned burns would have immediate effects to the cover and forage habitat ratios (3 to 5 years). This scenario should only impact individual elk and deer. The short term effects to their habitat (3 to 5 years) will not likely contribute to a loss of viability to their overall populations. After 5 years, the ratios should be back up to preburn conditions.

Figure 4-17 Hiding Cover/Forage % Ratio
Including Cumulative Effects
Short term 3-5 Years

Alternative 1	Alternative 2	Alternative 3	Alternative 4
40/60	27/73	27/73	32/58

1. Optimum habitat is defined in the Forest Plan as: 25% hiding cover, 15% thermal cover, 10% hiding or thermal cover, and 50% forage. Thermal cover is not applicable as the area is not winter range.

Forage competition with livestock would become less of a concern as more forage species become available.

Grazing by livestock and big-game has been identified as one of the main impacts to brood rearing habitat for Blue Grouse. Because livestock grazing would be restricted in areas being reforested, it is likely that the overall impact would be favorable during the short-term (20 years). The long term (greater than 20 years) impacts would also be favorable because the reforested areas would result in improved winter foraging areas.

Other planned, current, or reasonably foreseeable actions include harvesting in other unmanaged areas in the next 10+ years, recreation use (camping, fishing, travelling). Recreation is becoming a primary use within the project area. Summer camping, viewing, hiking, hunting, and bicycling all bring a large number of recreationists into the area during the summer and early months. Impacts from recreation would mostly come from travelling within areas with no roads and on unauthorized roads and trails. Effects result in many acres of lost foraging habitat (removal of herbaceous and browse species through soil compaction) and encroachment of wildlife security zones (habitat effectiveness concern).

Noxious weed invasion and the lack of aspen regeneration play an important role within the project area. As more forest users interact with this local landscape, the risk of continual weed encroachment increases. Currently, musk thistle, white top and Canada thistle are the dominant invaders within and near the analysis area. Acres may increase as human activities and natural dispersion continue. These noxious weeds slowly decrease the quality and quantity of the forage habitat needed by deer, elk and blue grouse.

In the short term (1-5 years), additional planned prescribed burns (for aspen regeneration) would impact security/cover habitat because it increases the foraging habitat. However, after 5 years, aspen regeneration greatly increases the amount and the existence of habitat that is needed for cover. The short-term effects should not affect the overall populations of deer, elk, and blue grouse.

The total effects from the proposal relative to all present, past and foreseeable actions should not have harmful impacts upon the local wildlife species provided all the design features are implemented. However, as future human actions increase, additional uses from possibly mining, more grazing, fire suppression, harvesting, prescribed burns, special uses, etc. would continue to affect the existing habitat. At this point, it is not really known if those effects would be negative or positive.

Cavity Nesting Species, Threatened and Endangered, Sensitive Species, Neotropical Birds,

Other forest use practices and natural events have affected wildlife habitat within the project area. Livestock and big-game grazing are primary forest uses that have decreased foraging opportunities and directly impacted individuals through forage competition and trampling. Foraging of livestock and big-game alter habitat and compete with prey species.

Past and present recreation activities may continue to impact wildlife species and their habitat. Developed forest trails, roads, summer camping, viewing, hiking, hunting, and 4-wheeling, all bring a large number of recreationists into the area, influencing the existing habitat. Cross-country motorized travel disturb vegetation habitat and encroach on security areas for wildlife.

Impacts from prescribed burning would include snag enhancement habitat which would benefit those species dependent on snags and those species that favor open forest types. The reverse is true for those species dependant on interior forested habitat. Northern goshawks would, in the short term, be negatively impacted through direct disturbance of nest sites and diminishing potential nest site habitat. Long-term effects include a perpetuating aspen for future nesting.

Noxious weed invasion is quickly influencing the habitat within and adjacent to the analysis area. As more forest users interact with this local landscape the risk of continual weed encroachment increases. Currently musk thistle, white top and Canada thistle are the dominant invaders. Acres of weeds may increase as human activities and natural dispersion continue. These noxious weeds slowly decrease the quality and quantity of the forage habitat needed by wildlife.

The total effects from the proposal relative to all present, past and foreseeable actions should not have harmful impacts upon the local wildlife species provided all the planned designed features for the project are implemented. However, as future human actions increase, additional uses from possibly mining, grazing, fire suppression, harvesting, prescribed burns, special uses, etc. will continue to affect the existing habitat.

4.8 TRANSPORTATION

This section of Chapter 4 discusses potential effects to Transportation. The key comparison elements for evaluating how the alternatives considered in detail respond to this issue, and their associated effects, are: Forest Development Road construction and reconstruction; reclamation of Forest Development Roads and nonsystem roads; post-project Forest Development Road, nonsystem road, and motorized trail access and density; conflicts with recreationists; and delays in travel from logging traffic and associated road work.

Forest users of all types require roads to access the resources. Transportation planning efforts consider the type and quantity of vehicles which need a road, how often, and for what duration. In conjunction with the Forest Plan and other management decisions, a transportation system plan is developed to accommodate users in travel need and safety. Road management is a combination of construction, maintenance, restrictions, and closures, depending upon resource and access needs. Roads are reclaimed when they no longer are needed for management of National Forest resources.

A transportation analysis was performed on the South Manti Timber Salvage Sales Environmental Assessment and is used for this analysis. Rangers and specialists met to look at resources, traveler needs, and existing Forest Development Roads and nonsystem roads. Some roads were noted to be causing resource damage, others were noted as causing a higher access density than necessary (e.g. Where three roads access the same area, when one road could adequately access the area). The Interdisciplinary Team determined that many of the nonsystem roads were not needed and should be reclaimed as funding becomes available. Roads that could be used for harvest and removal of timber would be improved as necessary. Some areas needed new roads constructed to facilitate the removal of timber. The new roads would be for both short- and long-term timber access. Access needs and durations were analyzed. Consequently, roads not needed for resource management activities were identified for reclamation.

The desire to harvest trees from the project area and the location of the sale units were the initiating drive for proposed road reconstruction and location. Aerial photography, topographic maps, and field reconnaissance were used for preliminary analysis. Where photo analysis or field reconnaissance indicated a road (as little as two wheel tracks), this alignment was mapped as possible access to timber.

Resource concerns like wetlands, riparian areas, and slump areas influenced road location primarily by avoidance. The design standard of 8 percent maximum grade influenced road location greatly.

DIRECT AND INDIRECT EFFECTS

Effects Common to All Alternatives

Existing Forest Development Roads would continue to receive maintenance. Unauthorized, unwanted additions to local roads may continue by Forest users.

Effects of Alternative 1

Transportation System

There would no effect to the transportation system from road construction. The existing road and motorized trail density in the area would remain at 2.4 miles per square mile, unless unauthorized motorized trails are established by Forest users.

Visitor Safety

Forest visitors may encounter up to 200 vehicles per day; every encounter has the potential to be an accident. Dispersed recreation, hunting recreation, fuelwood activities, range activities, and timber activities would continue to contribute to seasonal traffic volumes in and around the project area.

Access

Approximately 93 miles of Forest Development Road, nonsystem roads, and motorized trails would continue to exist and be used. This represents a motorized access density of 2.4 miles per square mile.

Effects of Alternatives 2, 3, and 4

Effects Common to Alternatives 2, 3, and 4

Transportation System

There would be road construction and reconstruction, resulting land needed for construction would be taken out of production. A portion of the roads would be reclaimed and put back to resource production.

All action alternatives would include the following: 15 miles of Forest Development Road reconstruction; 1 mile of Forest Development Road, associated with this project, closed to Level 1 maintenance; 4 miles of Forest Development Road reconstruction, not used with this project, to be reclaimed as funding becomes available; 18 miles of nonsystem roads, not used for this project, to be reclaimed as funding becomes available; and 8 miles of project temporary roads constructed and reclaimed after use.

Some roads would be improved by aggregate surfacing. Aggregate may be acquired off the Forest, however there are 2 aggregate sources in the project area that could be reopened and developed. Other potential sites, not currently planned for use, also exist which could be developed contingent upon approval.

No roads would be constructed or reconstructed into any of the RARE II inventoried roadless areas.

Visitor Safety

Forest visitors would encounter more vehicles on roads in the project area and on the Ferron-Mayfield road. With higher traffic volumes, there is an increased probability of accidents. Warning signs would be used to caution travelers of logging traffic and activities, traffic control flaggers would be used if necessary to ensure safety on Forest roads open to public travel. Additional project design features would be included to maintain visitor safety and their recreation experience (see Appendix D - Appendix J).

Increased vehicles on non-paved roads would displace and temporarily suspend dust particles which could affect road users. This could be a problem for visibility and vehicle control on washboard areas. However, dust abatement would be used to keep dust down and act as a particle binder to reduce washboarding.

Access

Through improvement of existing roads and the development of new roads Timber Sale Purchasers would have an adequate transportation system to facilitate log removal from the Forest. Over time, Forest users would see a decrease in roads from the current condition. This reduction would be due, in part, to the reclamation of some roads used for timber activities, and to a greater extent, the additional reclamation of roads not needed for future resource management activity.

Reconstructed roads would provide Forest visitors more safe and dependable access through aggregate placement, road widening, improved sight distance, and improved turnouts. Some reconstruction would have the same ground-disturbing effects as localized new construction due to the need for realignment, specifically: access into treatment unit F3. Improved access could likely increase the number of visitors to the Forest. Two trails are impacted by action alternatives due to reconstruction from trail widths to road widths. After use, the roadway would be returned to a trail.

All nonsystem roads would be reclaimed as funding becomes available. Approximately 70 miles of Forest Development Roads and motorized trails would remain in place for use by forest visitors. Road density (including all system, nonsystem, and nonsystem motorized trails) would decrease from 2.4 to 1.8 miles per square mile.

Travel Delay

In 1992, Forest visitors had very little logging related traffic to contend with. Drivers expected to meet cars, small trucks, and camper; while traveling to and within the Twelvemile area. The Ferron-Mayfield road was designed for 25 miles per hour travel speed, slower as conditions dictated. Now, with timber hauling vehicles using the road, travelers need to be cautious and travel at reduced speeds. All action alternatives would increase travel time about a minute for passing vehicles and an additional 1.5 minutes (average) when speed is reduced by 10 miles per hour per mile of road. During construction or reconstruction of roads, delay may be two hours on average. Construction delays would be expected on Forest Development Roads: #50044, #50150, #50049, #50161, and #50333. Construction delays would also be expected on system trails: #007 and #003. When necessary, these roads could be temporarily closed for longer blocks of time to facilitate construction activities on an as needed basis. Travel delay does not vary greatly between alternatives.

Effects Differing Between Alternatives 2, 3, and 4

Transportation

Alternative 2 is the only alternative which includes construction of a Forest Development Road, approximately 1 mile. This road construction would be within the Heliotrope Forest Plan inventoried roadless area. Alternative 2 also includes road maintenance of Forest Development Roads #50070 (0.5 miles) and #50285 (0.3 miles) in the Heliotrope Forest Plan inventoried roadless area.

Transportation management of Alternative 3 would be similar to Alternative 2, except that it would not construct the Forest Development Road in the Heliotrope Forest Plan inventoried roadless area.

Transportation management of Alternative 4 would be the same as Alternative 3, except that no road maintenance associated with timber harvest would occur within inventoried roadless areas.

Visitor Safety

Higher traffic volumes would increase the probability of accidents. With Alternative 2, Forest visitors would encounter an estimated 28 additional vehicles per day on the Ferron-Mayfield road. With Alternative 3, Forest visitors would encounter an estimated 27 additional vehicles per day on the Ferron-Mayfield road. With Alternative 4, Forest visitors would encounter an estimated 20 additional vehicles per day on the Ferron-Mayfield road.

Access

Alternative 2's road construction into the Heliotrope area (1.1 miles) would be a long-term addition to the system and placed in the category "Level 1 maintenance" after post-sale activities (fuel reduction and initial reforestation work) are completed. Once placed into Level 1 maintenance, the road would not be open to public motorized travel.

Alternative 3 and 4 would not construct the road into the Heliotrope Forest Plan inventoried roadless area.

CUMULATIVE EFFECTS

Visitor Safety: Cumulative effects under the 1996 South Manti Timber Salvage Environmental Assessment projected 25 vehicles per day from the combination of the Twelvemile timber sale, two exploration wells for oil and gas, and possibly two quarries opened for other projects. Since the publishing of the 1996 Environmental Assessment, the Twelvemile Timber Sale was completed thereby reducing 25 vehicles per day to 18 vehicles per day. The Duck and Six Timber Sales may still contribute vehicles to coincide with timber haul from any action alternative selected, and would add an estimated maximum of 11 vehicles per day, for a total of possibly 29 cumulative vehicles per day. (The Six Timber Sale is active through 2001, the Duck Timber Sale is active through, 2003).

Access: Construction activities associated with other timber sales in the area would be complete, therefore no additional effects to the system are anticipated. There is the potential for additional road construction to occur over the next 10 years associated with oil and gas exploration and quarry development. These areas have not been identified, but if developed in or near the project area, they could add to the road density if authorized.

Travel Delay: Impacts to general recreational travel would be minimized by several hauling restrictions (see Appendix D - Design Features).

RANGE ALLOTMENTS AND IMPROVEMENTS

This section of Chapter 4 discusses potential effects to Range. The key comparison elements for evaluating how the alternatives considered in detail respond to this issue, and their associated effects, are suitable rangeland restricted for timber regeneration, livestock restrictions, and range improvements affected.

DIRECT AND INDIRECT EFFECTS

Effects of All Alternatives

As spruce trees die, vegetative production would increase due to decreased competition with conifers and increased sunlight.

Dead spruce would continue to fall over time. With no treatment to break up or reduce fuel loading, the would be a risk of significant impacts from wildfire. The fire would burn until either fuels have been consumed or the conditions change to aid in extinguishment. Stand-replacement fires could effect range conditions. The degree of effect will depend on the time of year, the size and duration of the fire, and grazing schedule. Following prescribe burns in conifer stands to regenerate quaking aspen, one year rest and one year of deferred grazing has allowed understory vegetation to become established. However, following wildfire in very heavy fuels, establishment of understory will probably take longer.

If a fire does not occur when the dead trees fall to the ground, grazing may be difficult due to the amount of fuel loading on the ground.

Livestock Grazing

Reductions and altered management to some allotments could occur due to the loss of suitable range. Suitable range is defined as range accessible to livestock which can be grazed on a sustained yield basis without damage to the resource. There is the need to keep livestock out of the reforestation plantations long enough for the conifer seedlings to grow to a height of 4 feet because the seedlings are susceptible to damage from livestock. In some situations, sheep removal could occur for 7 to 10 years. In other situations, livestock removal could occur for 15 to 20 years. Possible means of accomplishing this could be through fencing, herding, scheduling, and altered management, or any combination of techniques. The effects would be similar with all alternatives but would vary according to the amount of the allotment impacted Figure 4-18 Decrease in Suitable Rangelands, displays the percent decrease in suitable rangelands by allotment and by alternative.

Figure 4-18 Decrease in Suitable Rangelands

CATTLE ALLOTMENTS	ALLOTMENT ACRES	SUITABLE ACRES	DECREASE IN SUITABLE ACRES			PERCENT DECREASE IN SUITABLE RANGELAND		
			Alt 2	Alt 3	Alt 4	Alt 2	Alt 3	Alt 4
Twelvemile	30,588	17,376	512	512	572	3.0	3.0	3.3
Sixmile	17,057	9,001	224	224	160	2.5	2.5	2.0
Ferron	69,648	26,767	236	236	0	.1	.1	0
Emery	52,976	31,305	832	832	670	3.0	3.0	2.0
Total	84,449	84,449	1,804	1,804	1,402	2.2	2.2	1.8

SHEEP ALLOTMENTS	ALLOTMENT ACRES	SUITABLE ACRES	DECREASE IN SUITABLE ACRES			PERCENT DECREASE IN SUITABLE RANGELAND		
			Alt 2	Alt 3	Alt 4	Alt 2	Alt 3	Alt 4
Island Lake	4,576	3,622	0	0	0	0	0	0
Lake Fork	1,547	1,162	76	76	76	7.0	7.0	7.0
Duck Fork	4,050	3,010	384	384	384	1.3	1.3	1.3
Indian Cr.	5,024	3,462	684	684	110	12.8	12.8	3.2
Heliotrope	4,848	3,365	44	44	20	1.3	1.3	.6
Peavine	4,733	3,804	190	190	190	5.0	5.0	5.0
Blue Lake	2,656	2,103	160	160	160	7.6	7.6	7.6
Sixmile	17,057	10,089 ¹	224	224	160	2.2	2.2	1.6
Total	44,491	30,617	1,762	1,762	1,100	4.7	4.7	4.2

¹. 1,088 Acres Suitable for Sheep Allotment Included in Total.

Although some acres may be closed to grazing, the impacts to the allotment may not directly correlate with the amount of suitable range impacted. An example of this may be an area that has 10 percent of the suitable range impacted, but only 2 percent of the animal unit months (AUM, the amount of feed necessary to support one thousand pound cow) come from that area due to the fact that some timber areas produce less forage per acre and are inaccessible. Some pastures in the cattle and sheep allotments may have to be closed because controlling sheep at night and the additional expense of fencing and maintenance may not be practicable. Some roads may be closed to livestock grazing for two to three years to provide for revegetation.

The impact to individual permittees may be adverse when they are required to alter management of their allotments. Additional costs could make some marginal operations economically unfeasible under current market prices. Some permittees have two or more allotments impacted by the timber sale.

Range Improvements

Short-term impacts to range improvements could occur, however any damage to improvements would be repaired or replaced by the Timber Sale Operator in a timely manner. Impacts could include tearing down and removal of fences and damage to cattle guards by heavy equipment.

CUMULATIVE EFFECTS

Economic revenue generated through grazing may decrease when required reductions are added to other reductions taking place throughout the forest. Some permittees have recently been required to reduce their permitted numbers to bring their allotments in line with carrying capacity. Additional reductions or increased herding costs could make marginal operations economically unfeasible.

4.10 VISUAL LANDSCAPE

This section of Chapter 4 discusses potential effects to the visual landscape. The key comparison element for evaluating how the alternatives considered in detail respond to this issue, and their associated effects, is post-activity visual quality condition.

DIRECT AND INDIRECT EFFECTS

Effects Common to All Alternatives

The landscape's visual diversity is not static. The effects of beetle-induced tree mortality has affected, and will continue to affect, the area's visual condition. Gradual change to visual character may be accelerated by effects of the beetle infestation and subsequent consequences (e.g. changes in the color of affected spruce trees, changes in vegetation, and increased potential for wildfire effects).

Over time, the natural processes may result in vegetative conditions more diverse with a richer variety in color and texture. Until visual recover, some Forest visitors may prefer to view dead spruce trees in the short-term instead of management-induced patterns from harvest areas and road work.

Although high intensity (stand-replacement) wildfires are not frequent events in the forest types present, the high mortality of spruce increased the fire hazard. Intense wildfires could have short-term adverse effects to visual quality by reducing the amount of green vegetation. In the long term, an intense wildfire could increase the landscape's color and texture through natural regeneration and the creation of

openings. The increased risk of mass soil movement, as discussed in the soils section, would be the greatest long-term negative effect to visual quality an intense wildfire could be expected to have.

Effects of Alternative 1

Present viewsheds and their Visual Quality Objectives (VQOs) would not be altered by management activities, changes would largely be by natural events. Views of beetle-infested areas, as perceived by the average Forest visitor, would not gain the relatively short-term improvement in color and texture that could result from removal of dead spruce and the long-term improvements from prompt reforestation.

Scenery would be subject to cyclical, natural disturbance processes such as fire, wind, drought, and vegetation succession. In approximately 100 years, the dead and dying spruce trees would be naturally regenerated and/or replaced by other species. Views would return to their pre-infestation condition or perhaps show improvement to the condition which existed immediately prior to infestation.

Effects of Alternatives 2, 3, and 4

Effects Common to Alternatives 2, 3, and 4

Disturbance caused by the construction of roads and the associated harvest of trees would have an impact on visual quality. This impact would be caused by contrasts created between the natural landscape and the managed landscape. This contrast involve changes in form, line, color, and texture of soil and vegetation.

In evaluating the specific effects for each alternative relative to scenic value, several variables come into play. Information such as road construction mileage and location, unit treatment, and unit size are relative to distance, angle, and duration of the view. For the purpose of this analysis, some interpretation is required to gauge the total change caused by an alternative in relation to meeting established visual quality objectives (VQO). This interpretation is based on aerial photography, topographic maps, existing Forest Plan VQO maps, and field reviews.

The relative dominance of management activities (harvest and roading) must be identified to determine if Forest Plan VQO standards would be met. If activities are designed to repeat form, line, color, and texture common to the characteristic landscape to a degree that changes in these characteristics are not evident to the casual Forest visitor, a VQO of Retention would be achieved. If these changes are evident, but remain visually subordinate to the characteristic landscape, a VQO of Partial Retention would be met. If changes in the characteristics visually dominate the landscape, but borrow from naturally established form, line, color, or texture so completely and at such a scale that its visual characteristics are those of natural occurrences within the surrounding area a VQO of Modification would be achieved.

Short-term improvements to visual qualities of color and texture would result from removal of dead spruce trees (i.e. improvement to color and texture from dead and dying timber removed). With the possible exception of some roads, landings, and skid trails, potentially dominant negative effects are far from permanent and would likely become non-apparent as slash was removed or burned and revegetation occurs.

Disturbance to vegetation begins to heal immediately, while soil disturbance can take years to be restored. The selective nature of the proposed salvage harvest would minimize the impact to visuals, leaving residual live trees. The post-harvest

reforestation would further accelerate visual recovery. The duration of recovery is directly related to the extent of disturbance. In 2 or 3 years, herbaceous vegetation would cover most disturbed sites. Within 25 to 30 years, tree cover would grow to the point where the visual impact is unnoticed. Opportunities to minimize visual effects are greatest on ground with slopes less than 30 percent. This is because the size and shape of a harvest unit can be manipulated on the gentler slopes more effectively to screen disturbance. The prohibition of ground-based yarding on steep slopes (over 40 percent) reduces the visibility that harvest activities might have when readily viewed.

The longest lasting visual disturbance is typically caused by soil movement, particularly from road construction. While harvested treatment units over time would recover to an "unnoticed" visual condition, even low standard roads can remain noticeable for generations.

The road maintenance on Forest Development Roads #50070 and #50285 would not adversely affect their relative dominance to the point of not meeting the present VQO

Timber harvesting and associated road building would modify the existing landscape to varying degrees, which would be more or less apparent at different distances. The significance of these actions would be dependent on the viewing distance.

The visual management system defines three distance zones: foreground is the distance at which detail such as tree limbs can be identified (usually up to 1/4 mile to 1/2 mile from the observer); middleground extends from Foreground to 3 to 5 miles from the foreground (texture is emphasized); and background is everything beyond middleground (colors and patterns dominate the visual impression).

Sights of timber salvage operations (i.e. landings, stumps, slash) would be visible in foreground and middleground, and could dominate sensitive foreground views. However, when design features (including revegetation) are properly implemented, foreground partial retention would be met. Harvested units of high insect infestation density, particularly if silhouetted against a backdrop of sky forming unnatural openings, may be noticeable at background distances. Middleground partial retention would not be achieved if harvest areas greatly differ in form and scale from the natural openings found in the surrounding landscape. Again however, it is expected that due to the nature of the infestation pattern, harvested edges would reasonably follow natural contours and generally reflect the natural form and line of historic openings created by fire and beetle mortality.

Disturbance associated with roads could dominate wherever it is visible, particularly in long views where an unnatural line may be apparent. The visually apparent results of road building (i.e. cut banks, fill slopes, right-of-way/shoulder clearing) would be clearly apparent in the foreground; some would be visible in the middleground, and may appear as a dominant element of line in the background view.

As for recreation-related to scenic viewing from major roads and trails the nature of the effects would be similar for all action alternatives, although the degree would differ. Recreation use patterns associated with visual quality could change in and adjacent to harvested areas. Disturbed areas could become less attractive to visitors who prefer an unmanaged scenic character. These visitors may choose not to return and go elsewhere.

Although it can be projected that recreation use patterns related to aesthetics would change, the amount of change is difficult to predict. However, some assumptions can be made. For the duration of the salvage harvest and for a period related to

regeneration afterward, some recreation users would be displaced to remaining or adjacent, less developed areas. On the one hand, this displacement could add to the cumulative sensation of becoming crowded that users experience as their traditional recreation spots are developed. On the other hand, improved access could make areas available for more recreational use, such as short duration hunting 'rips and for mountain bike or ATV users. Once roads are closed, their presence remains to some extent, and their presence provides increased access for hikers and those with horses to enter the area.

Because there is little proposed road construction/reconstruction in the more visually sensitive viewsheds along major roads and trails, nor in any of the inventoried roadless areas (except for Heliotrope which was not carried through the Rare II process due to lack of suitability), the most pertinent areas of the project would remain within established VQO parameters. This is only true in this project's case given successful completion of identified design features. This is due to the fact that most of the project area is already in partial retention, and very little is in retention.

Throughout the entire project area, approximately 14 miles of roads would be reconstructed within areas designated as Partial Retention. Only the infested, dead and dying spruce would be harvested using ground-based yarding techniques on slopes less than 40 percent, and cable or helicopter logging would be permitted on slopes greater than 40 percent. Natural and artificial reforestation activities would be employed. Although new roads associated with salvage operations would be revegetated following completion, road/soil scarring could possibly remain as a dominant visual element for many years.

Effects Differing Between Alternatives 2, 3, and 4

Alternative 2 would have the greatest potential direct effects to the visual landscape based upon the amount and character of activities it includes. The road construction included in Alternative 2 would be within an area designated as partial retention.

With Alternative 3's exclusion of road construction/reconstruction within inventoried roadless areas and requirement of helicopter yarding within inventoried roadless areas, it would have less direct effects than Alternative 2 to the visuals of these areas. Since Alternative 3 would not construct the Forest Development Road proposed in Alternative 2, the potential visual effects of that road would be removed.

With Alternative 4's exclusion of activity within inventoried roadless areas, there would be no direct impacts to their aesthetics. Overall, Alternative 4 would have the least amount of impacts to the visual landscape in comparison to the other action alternatives.

CUMULATIVE EFFECTS

Past roading has left a long-term effect upon visuals. On-the-ground reviews of past harvested areas show that they blend in with the surrounding landscape due to the amount of residual trees and snags retained. Other past vegetation treatments have likewise had minor effects to visuals. The proposed action alternatives would add to the visual effects of unnaturally appearing line, texture, form, etc. already caused by management in the area.

4.11 UNDEVELOPED CHARACTER

This section of Chapter 4 discusses potential effects to Undeveloped Character. The key comparison elements for evaluating how the alternatives considered in detail respond to this issue, and their associated effects, are scenic condition, recreation experience, and motorized access network.

DIRECT AND INDIRECT EFFECTS

Effects Common to All Alternatives

Overall, the project area has been impacted and influenced by people and their activities. Outside of the inventoried roadless areas, it is difficult to find areas having an Undeveloped Character.

The overall Undeveloped Character of the area is not expected to notably change because the types of activities, facilities, recreational experiences, and scenery available would remain essentially the same for all alternatives due to developments and activities that already exist.

Effects of Alternative 1

Alternative 1 would neither directly increase nor decrease the Undeveloped Character of the project area. However, there may be indirect effects to potential Forest visitor use and experience as a result of the dead and dying trees across the landscape.

Alternative 1 has 93 miles of Forest Development Roads, nonsystem roads, and nonsystem motorized trails. These 93 miles of motorized access correlates to a motorized network density of 2.4 miles per square mile within the project area. Implementation of the Alternative 1 would not reduce the motorized access, and its effects to Undeveloped Character would persist.

Effects of Alternatives 2, 3, and 4

Effects Common to Alternatives 2, 3, and 4

Undeveloped Character of the area could be affected by timber harvest and roading. In general, increased timber harvest and roading is likely to reduce Undeveloped Character. The potential to impact Undeveloped Character is also related to the yarding system used. Since helicopter yarding typically results in less on-the-ground impacts than ground-based yarding, it would be expected to have less of an impact to undeveloped character than ground-based yarding. Cable yarding is perceived to have a greater degree of ground disturbance than helicopter, but a lesser degree of ground disturbance than conventional ground-based yarding. The relative difference in ground disturbance, may have a correspondingly similar effect to Undeveloped Character.

Some impacts, such as the sounds of project activities, would occur only during the immediate time of the activity. Other impacts, such as tree marking paint, skid trails, and logging slash, would be short term (up to 10 years). And yet, other impacts such as roads (cut slopes, fill slopes, roadway) and tree stumps would be evident much longer (20 to 40 years).

Implementation of the Alternatives 2, 3, and 4 would reclaim approximately 4 miles of Forest Developed Roads and 18 miles of nonsystem roads. This would reduce the motorized access to 70 miles, with a corresponding motorized network density of 1.8

miles per square mile. The reduced access and rehabilitation of an unnatural features, roads and trails, would positively affect undeveloped character.

Given the current managed state of the area, Forest users may not further differentiate the impacts from the action alternatives upon the existing Undeveloped Character. The selective nature of the proposed harvest plays a key role in minimizing one's potential perceived landscape alteration. Impacts from any of the action alternatives to Undeveloped Character are not expected to notably alter the recreational use patterns of the area.

A summary of potential impacts to Undeveloped Character can be qualitatively made by the resulting scenic condition.

In areas where the existing condition of Undeveloped Character has a Natural Appearing scenic condition (30%), the Undeveloped Character would largely remain intact due to planned avoidance of these areas.

The majority of the project area (63%), which has a Slightly Altered scenic condition of Undeveloped Character, would be temporarily impacted. Eventually, after salvage harvest operations and reforestation is complete, the affected areas should return to a level still within the subordinate parameters of Slightly Altered Undeveloped Character.

The small percentage of Moderately Altered Undeveloped Character (7%), which presently exists as a fragmented landscape, would be able to absorb salvage-related impacts (including road work). The casual Forest visitor would not notice much change from the existing condition, and if so, only temporarily. In fact, in areas of these Moderately Altered landscapes, road reclamation would improve the present level of Undeveloped Character in the longer term.

Effects Differing Between Alternatives 2, 3, and 4

Based upon yarding systems and their relative ground-disturbance, Alternative 2 would have the greatest potential to affect Undeveloped Character. Correspondingly, Alternative 3 would have a slightly less potential than Alternative 2 to affect Undeveloped Character. With less acreage harvested, Alternative 4 would have even a lower potential to affect Undeveloped Character.

Alternative 3 would have less effects to the Undeveloped Character of the inventoried roadless areas than Alternative 2. This is because Alternative 3 would not build roads into or ground-based yard within any inventoried roadless area.

Alternative 4 would have even greater reduced effect to the Undeveloped Character of the inventoried roadless areas than Alternatives 2 and 3. This is because Alternative 4 would not road or harvest within inventoried roadless areas, thereby removing the potential for direct impact to those areas.

CUMULATIVE EFFECTS

In general, the types of activities, facilities, recreational experiences, and scenery available in the area will remain the same for all alternatives due to the amount of impacts that already exist in the project area.

4.12 CULTURAL RESOURCES

This section of Chapter 4 discusses potential effects to cultural resources. The key comparison elements for evaluating how the alternatives considered in detail respond to this issue, and their associated effects, are the potential to affect paleontological/cultural resources, expected sites and effects to them, and sites eligible for listing in the National Register of Historic Places.

Potential effects to cultural resources are considered through a phased process: 1) development of a cultural resource sensitivity model to guide inventory; 2) inventory of all areas of potential ground disturbing activities prior to project implementation; 3) evaluation of all identified cultural resources for their National Register eligibility; and 4) development of protection measures for eligible sites.

This phased process is carried out under the terms of an approved Memorandum of Understanding (MOU) between the USHPO and the Forest. This agreement specifies requirements for archaeological inventory, site evaluation, and site protection in compliance with Section 106 of the National Historic Preservation Act (NHPA). In accordance with the MOU, the Forest has consulted with Native American groups. Any concerns subsequently identified by Native Americans will be appropriately addressed.

In accordance with the implementing regulations of the NHPA (36 CFR 800.9), project effects on cultural resources are classified as no effect, no adverse effect, or adverse effect.

A "no effect" determination means that cultural resources would not be impacted.

A "no adverse effect" would be an action whereby the value of a cultural resource can be preserved by completing appropriate research; or as in the case of a historic building, proposed alterations are done in such a way that the historical architectural values are preserved.

When a site is designated as being eligible for the National Register of Historic places, an "adverse effect" is any event that changes the characteristics which make that property ineligible. These characteristics are defined in 36 CFR 60.4 and Section 101 of the NHPA. In addition, an adverse effect can be one in which an activity produces conditions which would lead to: destruction or alteration of all or part of the property; isolation from its surrounding environment; or introduction of visual, audible or atmospheric elements that are out of character with the property or alter its setting.

DIRECT AND INDIRECT EFFECTS

Effects Common to All Alternatives

The cultural resource inventory for this project is approximately 95% complete. When the remaining inventory is completed and any additional archaeological sites are located, they will be recorded and evaluated. All known sites are now preserved in place by avoidance, and sites subsequently discovered in the project area will be preserved in place where possible through project design, redesign, and/or project modifications. If avoidance is not possible or feasible, appropriate measures to mitigate impacts through site recording, scientific excavation, analysis, and reporting will be developed and implemented in consultation with the Utah State Historic Preservation Office (USHPO) and the Advisory Council on Historic Preservation. This work will be conducted following Federal and Agency requirements.

Avoidance of all substantial paleontological and cultural resources in place is the preferred management option. This is the option to be used for all of the known eligible prehistoric sites in the project area.

Effects of Alternative 1

With no proposed ground disturbance, Alternative 1 represents no direct effects to cultural resources. The continued use of the area for recreation has the potential to indirectly affect cultural resources.

Effects of Alternatives 2, 3, and 4

Effects Common to Alternatives 2, 3, and 4

Timber harvest, road work, and associated project activities have the potential to directly and indirectly affect cultural resources. Access and ground disturbance increases the potential to affect cultural resources. However, following the MOU would protect known and subsequently discovered cultural resources.

Potential effects to paleontological and cultural resources have been assessed within areas proposed for timber harvest and associated ground disturbance areas. The risk of impacting historical and archaeological sites is assumed to be greatest in areas of potential site locations.

Paleontological Resources: No known paleontological resources would be affected. If found, sensitive paleontological resources would be documented, evaluated, and protected as appropriate.

Prehistoric Cultural Resources: By following the requirements of the MOU, it is anticipated that activities associated with action alternatives would have a low potential for impacting prehistoric cultural resources. Subsequently identified sites would be avoided or mitigated. Therefore there would be a "no effect" determination for these sites under NHPA.

Historic Cultural Resources: Historic maps and previous surveys show that between nine and eleven historic sites are located within or directly adjacent to proposed harvest units or road locations planned for construction/reconstruction. These sites would be avoided or mitigated. Therefore there would be a "no effect" determination for these sites under NHPA.

Ground-based yarding systems pose the most potential to impact cultural resources. Helicopter yarding is considered to have the lowest potential of impacting sites because of less ground disturbance.

Post harvest activities such as reforestation or resource surveys within surveyed harvest units would not require additional cultural resource inventory.

Indirect effects, such as site damage or unauthorized artifact collection, could potentially result from increased access. After completion of the project, closing temporary roads used for the project should protect sites and discourage unauthorized collections.

For occurrences of later discoveries, such as very large eligible sites, avoidance may not be feasible. In these cases, the Forest would select from a variety of options including test excavation, collecting surface artifacts, monitoring ground disturbing activities, and/or conducting data recovery through more extensive excavation. This

work would be conducted by professional archaeologists in consultation with the USHPO and under the stipulations of the MOU.

Final determination of effects to paleontological and cultural resources is contingent on the alternative selected for implementation and completion of pending surveys.

Effects Differing Between Alternatives 2, 3, and 4

Area Surveyed). Survey has identified 28 sites: 22 of which included prehistoric cultural resources, and 8 of which included historic cultural resources. Most sites are small in size and are located in relatively level or gently sloping terrain. Following the MOU guidelines would protect identified sites.

Figure 4-19 Harvest Area Surveyed

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Acres Proposed for Harvest	0	6,530	6,530	3,974
Harvest Area Surveyed (acres)	N/A	2,843	2,843	2,843
Survey Results (Sites Identified)	28	28	28	28

Although following the MOU would protect sites, the potential risk of affecting paleontological and cultural resources is relative to the amount of access and ground disturbance. Alternative 2 has the greatest potential to affect cultural resources in terms of access and ground disturbance. Although Alternative 3 would harvest the same acreage as Alternative 2, it would have less potential to affect paleontological and cultural resources since it would not construct roads into the inventoried roadless areas. Of the action alternatives, Alternative 4 would have the least potential impact on paleontological and cultural resources because it would harvest less acreage, include less road work, and not enter the inventoried roadless areas.

Some areas remain to be surveyed for each of the action alternatives. Pending inventories would be conducted consistent with the accepted modelling protocol before project implementation. Actions would be taken, in compliance with the MOU, to afford subsequently identified sites appropriate protection. Figure 4-20 Estimated New Prehistoric Sites, indicates the remaining acreage to be surveyed in each sensitivity zone and the number of prehistoric sites expected to occur (based on the survey model).

Figure 4-20 Estimated New Prehistoric Sites¹

Sensitivity Zone	Alternative 1	Alternative 2	Alternative 3	Alternative 4
High (100% survey)				
Areas Needing Survey	0 acres	84 acres	84 acres	41 acres
Expected Number of Sites	0 sites	0-1 sites	0-1 sites	0-1 sites
Moderate (40-50% survey)				
Areas Needing Survey	0 acres	144 acres	144 acres	18 acres
Expected Number of Sites	0 sites	1-4 sites	1-4 sites	0-1 sites
Low (10% survey)				
Areas Needing Survey	0 acres	63 acres	63 acres	4 acres
Expected Number of Sites	0 sites	0-1 sites	0-1 sites	0 sites

¹ Based on the survey model.

CUMULATIVE EFFECTS

All projects (past, present, and reasonably foreseeable) are to be in compliance with laws, regulations, and policies regarding cultural resources - thereby reducing potential effects.

Potential exposure of paleontological and cultural sites to the public by continued and/or increased access to the area could encourage artifact collection or activities that could affect these resources. Over time, this could result in a loss of potential information about paleontological and cultural resources.

4.13 ECONOMICS

This section of Chapter 4 discusses potential effects to economics. The key comparison elements for evaluating how the alternatives considered in detail respond to this issue, and their associated effects, are projected employment, payments to Counties, and economic efficiency.

DIRECT AND INDIRECT EFFECTS

Effects Common to All Alternatives

A comprehensive economic analysis was completed as part of the Forest Plan planning process. That analysis addressed both amenity (market, consumptive) and non-amenity (non-market, non-consumptive) resources. Non-consumptive resources include such things as recreation opportunities, cultural resources, wildlife habitat, etc. The purpose of the economic analysis for this project is to provide a comparison of economic viability between alternative actions.

Each alternative has an array of non-amenity costs and benefits which are difficult, if not impossible, to accurately model. Non-amenity costs and benefits are beyond the scope of this analysis.

Effects of Alternative 1

The direct and indirect effects of implementing Alternative 1 are presented in Figure 4-21 through Figure 4-25. A benefit-cost ratio was not calculated for Alternative 1 because it does not create benefits in the form of revenue. Alternative 1 would not provide additional employment and income opportunities, and returns to the Counties as payments in lieu of taxes would be foregone.

Effects of Alternatives 2, 3, and 4

Effects Common to Alternatives 2, 3, and 4

Timber salvage harvest of the dead and dying spruce trees is a tool which is responsive to the identified purpose and need for the project. It may be the most effective and efficient tool currently available. Other contractual arrangements such as service contracts with salvage rights also remain viable methods for salvage removal.

Spruce trees are a preferred species for house logs, and currently there is a market for dead and dying spruce trees. The demand for house logs is increasing, as are inquiries to the Forest about the availability of dead spruce trees. The dead spruce trees within the project area could supply a portion of the raw material for the house log demand. Each action alternative would harvest merchantable timber for use as house logs and/or other wood products.

All of the action alternatives would contribute to employment and income opportunities through the harvest of timber (i.e. timber sale preparation, logging operations, trucking, timber processing, and post sale activities). Induced economic benefits to primary and secondary businesses would be expected.

Twenty-five percent of timber sale receipts would be returned to Counties as payments in lieu of taxes to fund schools and roads. The remaining receipts could be deposited in the Salvage Sale Fund, KV (Knutson-Vandenberg) Fund, or returned to the National Treasury.

Deficit timber sales would be offered for sale at the minimum base rate of 10,000 dollars per million board feet of timber (\$10,000/MMBF). It is possible timber purchasers would bid on and be awarded sales at the minimum base rate. For example, the Dixie and Manti-La Sal National Forests have awarded sales which included helicopter logging at the minimum base rate. Although economic data is sparse for helicopter harvest in this area, these qualitative indications suggest that such a venture is reasonable.

Areas are identified for harvest based on technical operability, environmental acceptability and the need to remove dead and dying timber as a step in ecosystem rehabilitation. Increased helicopter yarding volume reduces the likelihood that all areas identified for harvest would in fact be harvested. Scoping comments from Louisiana-Pacific Corporation on the project, indicate that large sale offerings could contain up to 30 percent helicopter yarded volume and still remain feasible for their operations.

Economic considerations suggest that offering different combinations of the proposed harvest units for sale could improve the economic viability for prospective timber purchasers. For example, offering a sale with less helicopter yarding and more ground-based yarding would likely improve the sale's viability. Such sale packaging would eliminate or help offset some of the high costs of helicopter yarding.

Economic considerations also suggest that combination of proposed harvest units from this project with other harvest areas outside of this project could improve the economic viability for prospective timber purchasers.

The amount that would be contracted and harvested depends upon market conditions which vary through time and the specifics of the contractual instrument used to authorize removal (e.g. timber sale contract, service contract, etc.).

Effects Differing Between Alternatives 2, 3, and 4

The direct and indirect differences between the action alternatives are strongly related to the amount of timber to be harvested, how the timber would be yarded, and the amount of associated road work. The values for each of these characteristics are presented in Figure 4-21 Key Characteristics Affecting Economics. The estimated low value of dead timber and expected post harvest costs are characteristics common to all action alternatives.

Figure 4-21 Key Characteristics Affecting Economics

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Timber Harvest (MMBF)	0	32	32	20
Ground based Logging (MMBF, % of Total Harvest)	0 MMBF 0%	7.9 MMBF 25%	5.4 MMBF 17%	5.4 MMBF 27%
Helicopter and Cable Logging (MMBF, % of Total Harvest)	0 MMBF 0%	24.1 MMBF 75%	26.6 MMBF 83%	14.6 MMBF 73%
Road Construction (miles)	0	1.1	0.0	0.0
Road Reconstruction (miles)	0	16.0	15.0	15.0

The number of jobs that would potentially be created from implementation of each alternative are presented in Figure 4-22 Jobs Created and Induced Income. The potential increase in jobs and income could benefit both local and regional economies.

Figure 4-22 Jobs Created and Induced Income

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Jobs Created ^{1,3}	0	346	346	216
Income Produced ^{2,3}	\$0	\$18,275,000	\$18,275,000	\$11,422,000

- Jobs created were derived from the multiplier of 10.8 jobs per million board feet (MMBF).
- Income produced was derived from the multiplier of \$71,095 dollars per MMBF per year. Numbers are rounded to the nearest thousand dollars.
- The multipliers for these values were based on the Manti-La Sal National Forest 1997 Fiscal Year Timber Sale Program Information Reporting System (TSPIRS) report.

Stumpage value of dead and dying spruce is influenced by the combination or ratio of ground-based yarding and helicopter yarding designed into a sale. Timber sites, which could be logged only by ground-based equipment, would have a dead spruce stumpage value of about \$100 per MBF. By contrast, a site requiring helicopter yarding would have a dead spruce stumpage value of about -\$136 per MBF. Further analysis indicates that a sale design with 60% of the volume logged by ground based equipment and 40% helicopter logged would appraise at about \$5.00 per MBF.

Current appraisal information indicates that timber sales designed with the ground-based yarding and helicopter yarding percentages (ratios) illustrated in Figure 4-20 Key Characteristics Affecting Economics would all appraise deficit. The modelled sales indicate the high costs of helicopter logging. Average deficit for Alternative 2 would be about -\$78 per MBF, for Alternative 3 about -\$96 per MBF, and for Alternative 4 about -\$72 per MBF. The average deficit can be seen as a relative measure of the likelihood that all identified timber volume could actually be sold.

Dead and dying spruce, which appraises at a deficit stumpage value, would be advertised for sale at a base rate of 10,000 dollars per million board feet of timber (\$10,000/MMBF). Based on this rate, the revenue expected from each action alternative and the corresponding payments to counties in lieu of tax are presented in Figure 4-23 Generated Revenue and Payments in Lieu of Tax (PILT) is also referred to as the 25% Fund. The amount of payments that each individual County receives is relative to how much of the generated revenue came from within that County.

FIGURE 4-23 Generated Revenue and Payments in Lieu of Tax ¹.

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Generated Revenue	\$0	\$320,000	\$320,000	\$200,000
Total PILT	\$0	\$ 80,000	\$ 80,000	\$ 50,000
Sanpete County PILT	\$0	\$ 60,000	\$ 60,000	\$ 37,000
Sevier County PILT	\$0	\$ 20,000	\$ 20,000	\$ 13,000

¹ Numbers are rounded to the nearest thousand dollars.

The economic efficiency of each alternative was analyzed using the present net value of revenues and costs expected during the life of the project. Present net value can be viewed as the amount of money the decision maker would or would not have in hand as a result of implementing an alternative. The present net value presented for this project only considers the economic costs and returns of implementing the project.

The present net value of all sales appraised deficit. A deficit appraisal indicates that more money would be spent to implement the entire project (including post harvest activities) than would be made from the sale of timber. Figure 4-24, 1998 Present Net Value, displays the appraised 1998 present net value for each alternative.

FIGURE 4-24 1998 Present Net Value ¹.

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Interest rate at 4%	(\$ 74,000)	(\$3,777,000)	(\$3,753,000)	(\$2,485,000)
Interest rate at 6%	(\$ 72,000)	(\$3,499,000)	(\$3,477,000)	(\$2,291,000)
Interest rate at 7%	(\$ 72,000)	(\$3,374,000)	(\$3,352,000)	(\$2,205,000)
Interest rate at 10%	(\$ 70,000)	(\$3,045,000)	(\$3,025,000)	(\$1,983,000)

- Numbers in parentheses are negative. Numbers are rounded to the nearest thousand dollars. Revenues and costs were specifically developed for the project reflecting local, current values. Only revenues and costs to implement the project were considered. Harvest was modelled over the years of 1999 through 2005. Reforestation was modelled over the years 1999 through 2014. Timber prices were estimated using the Intermountain Transaction Evidence Appraisal System. Optional cable logging, although less expensive, was modelled as helicopter logging. All alternatives include the cost to prepare this document, estimated at \$73,651. The INVEST V (1994) economic analysis model was used to determine the present net value.

While the present net value is useful for a comparison between alternatives, it should not be misinterpreted to imply the overall value of an alternative. There are both non-amenity costs and benefits not represented in this calculation of present net value of recovering a marketable product. Examples of non-amenity benefits could be fuel reduction, reduced soil erosion, reduced long-term sediment in streams, and safer travel corridors from improved system roads.

When costs for timber sale preparation and harvest operations are incurred, fuel reduction costs are inherently a part of the overall timber cost. The economic benefit of a reduced probability for a wildfire start is difficult to compare with the negative costs associated with loss of soil productivity from wildfire. Other sections in this document discuss the environmental relationships of an intense wildfire.

Other benefits which cannot be easily be measured in dollar quantities include: reduced soil erosion and effects on wildlife and vegetation following closure and reclamation of Forest Development Roads and nonsystem roads; long term sediment

reduction in streams resulting from reconstruction of existing roads (reconstruction includes gravel to stabilize road travel surfaces and repair of stream crossings); improved travel of Forest Development Roads following reconstruction due to increased turn-outs, graveling of road surfaces, and increased sight distance. Timber salvage harvest activity is probably the least cost method to accomplish rehabilitation in the spruce stands.

Alternatives 2 and 3 have similar deficit present net values. This similarity is largely because both alternatives would harvest the same amount of timber, which was appraised at a base rate of \$10,000/MMBF. Alternative 4 is the least deficit action alternative regarding net present value because it would harvest less timber, require less helicopter logging, and include less road work.

The benefit-cost ratio, with a 4 percent interest rate, is summarized in Figure 4-25 Benefit-Cost.

Figure 4-25 Benefit-Cost ¹.

	Benefit (\$)	Cost (\$)	Benefit-Cost Ratio
Alternative 1	0	- 73,658	N/A
Alternative 2	1,238,250	- 5,015,646	.25/1
Alternative 3	1,238,250	- 4,991,646	.25/1
Alternative 4	600,000	- 3,084,896	.19/1

¹ Interest rate discounted at 4%.

With a higher interest rate, the benefit-cost ratio slightly differs between alternatives. With a 6 percent interest rate, Alternatives 2 and 3 would have a benefit-cost ratio of .25/1, and Alternative 4 would have a benefit-cost ratio of .20/1. With a 10 percent interest rate, Alternatives 2 and 3 would have a benefit-cost ratio of .26/1, whereas Alternative 4 would have a benefit-cost ratio of .21/1. The greater benefit value of Alternatives 2 and 3 implies that they have a slightly greater economic efficiency than Alternative 4.

One thing not apparent from the calculated present net values and benefit-cost ratios is the actual extent of potential deficit that a Timber Sale Purchaser would incur. A Timber Sale Purchaser may have greater actual costs because a comparison between the value of the timber and the cost of implementing the project could be less than the base rate advertised for the timber sale.

CUMULATIVE EFFECTS

Between 1992 to 1997 the Timber Canyon and Twelvemile Timber Sales harvested about 6 MMBF of insect infected and dead spruce trees from the project area. These sales contributed to the local and regional wood products industries. These sales generated an estimated 60 jobs and 3.2 million dollars in income and Sanpete County received approximately 203,500 dollars as payments in lieu of taxes.

The Olga, Camel, Oley, Baldy, Six, and Duck Timber Sales are scheduled to harvest about 21 MMBF of at risk and dead spruce trees from the project area within the next 5 years. Of these sales, the Camel Timber Sale was completed in 1997. These sales will contribute to the local and regional wood products industries. These sales are expected to generate an estimated 232 jobs and 12.3 million dollars in income and Sanpete County should receive approximately 326,700 dollars as payments in lieu of taxes.

Four timber sales located outside the project area, but on the Manti Division of the Manti-La Sal National Forest are likewise contributing to the local economy (Four Mile II, Four Mile III, Spoon Creek II, and Bear Ridge). When completed they will harvest 3 MMBF. About 33 jobs and 1.7 million in income may be generated by this harvest. Payments in lieu of taxes from these sales would be about 6,500 dollars to Emery County, 1,500 dollars to Juab County, 1,200 dollars to Sanpete County, and 4,500 dollars to Utah County.

Future management options to recover the dead timber would also be forgone as dead timber becomes unmerchantable with time.

4.14 ENERGY

This section of Chapter 4 discusses potential effects to energy. The key comparison elements for evaluating how the alternatives considered in detail respond to this issue, and their associated effects, is fuel consumption and output.

DIRECT AND INDIRECT EFFECTS

Effects Common to All Alternatives

With the increasing world demand for fossil fuels and escalation of energy prices, energy characteristics of forest management are a concern, which merits consideration. Disclosure of energy consumption is required under the National Environmental Policy Act (40 CFR 1502.16). Energy consumption was calculated using "Methods for Evaluation Energy Effects of Forest Management Alternatives" (Schwarzbart and Schmitz, 1982).

Effects of Alternative 1

There would be no direct or indirect effects to the energy resource with implementation of Alternative 1.

Effects of Alternatives 2, 3, and 4

Effects Common to Alternatives 2, 3, and 4

Timber harvest activities, associated road work, and project traffic would contribute to the consumption of energy.

Effects Differing Between Alternatives 2, 3, and 4

The direct and indirect effects of implementing the action alternatives are presented in Figure 4-26 Direct and Indirect Effects to Energy.

Figure 4-26 Direct and Indirect Effects to Energy

	Alternative 2	Alternative 3	Alternative 4
Energy Consumed (MMBTU ¹ /year)	165,193	>165,193	121,824
Energy Output (MMBTU/year)	204,063	204,063	150,490

¹ MMBTU = Millions of British Thermal Units

Energy consumption is represented by the use of petroleum products to run project related equipment and vehicles. Energy output is represented by the direct fuel value of the harvested timber.

CUMULATIVE EFFECTS

Approximately 5,156 Million British Thermal Units (MMBTU) per year of energy are currently consumed in the area by forest resource activities (recreation, special use permits, timber sales). Energy consumed by implementation of the action alternatives would add to the existing consumption level.

4.15 ROADLESS CHARACTER

This section of Chapter 4 discusses potential effects to roadless character. The key comparison elements for evaluating how the alternatives considered in detail respond to issue, and their associated effects, are direct impacts to inventoried roadless areas and post-activity roadless characteristics as reflected by natural integrity, apparent naturalness, solitude, remoteness, manageability, and special features.

DIRECT AND INDIRECT EFFECTS

Effects Common to All Alternatives

Past management activities have impacted the roadless character of the area.

Past public uses and activities have affected the roadless character of the area.

Present recreation activities in roadless areas are relatively non-impactive, such as hunting on foot or by horse, and backpacking. Trails in roadless areas, particularly motorized ones, reduce the sense of remoteness and solitude. Unauthorized motorized use of nonsystem road and trails further reduces roadless character.

Ongoing public use and activities would be expected to continue to impact the area's roadless character. However, the present levels of natural integrity, apparent naturalness, remoteness, solitude, special features, and manageability would remain primarily affected by natural processes.

Effects of Alternative 1

Alternative 1 would not develop any of the inventoried roadless areas with vegetation treatments or road work, nor would it develop lands adjacent to inventoried roadless areas. Therefore, there would be no direct or indirect effects on roadless character of these areas from implementation of Alternative 1.

Differing from the action alternatives, Alternative 1 would not reclaim additional Forest Development Roads, nonsystem roads, or nonsystem motorized trails. Correspondingly, the potential benefit of such measures to roadless character would not be realized.

Effects of Alternatives 2, 3, and 4

Effects Common to Alternatives 2, 3, and 4

Timber harvest and associated road construction would directly change the physical and biological aspects of the land, consequently affecting the six roadless characteristics. The modified setting would heighten one's sensation of being in a developed area. The character of the landscape would change because the sights, sounds, and other evidence of people would be present.

Some vegetation management effects on roadless character would be short-lived (e.g. unit flagging, tree paint, trees left with scars from logging such as where they were bumped by a felled tree or logging equipment). Other changes to roadless character from the vegetation management would be long-lived (e.g. road construction cut and fill slopes, cut tree stumps, skid trails, resulting openings, and changes in the vegetative patterns).

Additionally, activities associated with the vegetation management are not confined to the immediate area of activity. The sights and sounds of road construction, timber harvesting and yarding, and motorized access would be noticed for some distance beyond the area directly affected by the action alternatives. Areas containing or visually adjacent to roads and harvest areas would be proportionately modified in natural integrity and apparent naturalness. In these areas, opportunities for solitude and a related sense of remoteness would be reduced or eliminated.

Helicopter yarding would have negligible ground disturbing impacts to roadless characteristics, except for limited areas used as helicopter landings (at most 1-acre per landing). Consequently, harvest of helicopter units typically does not affect an area's roadless characteristics. Alternative 2 would have 2 helicopter landings within inventoried roadless areas. Alternative 3 would only have 1 helicopter landing within an inventoried roadless area. Alternative 4 would not have any helicopter landing within inventoried roadless areas.

The project's impacts to the roadless character could change the recreational use of the area. Potential Forest users seeking a relatively primitive recreation experience might choose not to visit the area subsequent to increased development, and the number of Forest users seeking a more modified setting could increase. Indirectly, salvage activity occurring outside of the roadless areas themselves could also have the effect of encouraging recreationists to use the relatively less developed roadless areas for camping, etc. The roadless character of these areas located near the timber sale could be degraded as recreationists move into these areas in order to avoid logging activities and to seek a more unmodified natural setting.

Harvest and associated road work could remove future opportunities to designate affected portions of inventoried roadless areas, or the whole inventoried roadless area, as roadless and eligible for recommendation as wilderness (based on parameters used in RARE II recommendations for wilderness consideration). If any of the six roadless characteristics were removed to the extent that the remaining area maintaining the six roadless characteristics occurred on less than 5,000 acres, the roadless area would not be eligible for future designation as roadless and recommendation as wilderness under current policies.

All action alternatives would reclaim 18 miles of nonsystem roads to discourage inappropriate motorized use across the landscape. This road reclamation should offset other negative impacts associated with improvements of existing Forest Development Roads. Upon completion of the action alternatives, road densities would decrease from 2.4 to 1.8 miles per square mile. This would reflect an improvement in roadless character of the area.

Figure 4-27 Inventoried Roadless Area Impact Summary, summarizes the current size and roading of the inventoried roadless area. Figure 4-27 Inventoried Roadless Area Impact Summary, also summarizes the proposed new Forest Development Road mileage, harvest acreage, and resulting percent of the roadless area affected.

Figure 4-27 Inventoried Roadless Area Impact Summary

Inventoried Roadless Area	Alternative 2	Alternative 3
Big Bear Canyon (25,782 Acres, 21.8 Miles Existing Roads)		
Miles of New Road	0	0
Acres of Harvest	0	0
% of Roadless Area Affected	0%	0%
Black Mountain (6,580 Acres, 10.3 Miles Existing Roads)		
Miles of New Road	0	0
Acres of Harvest	465	465
% of Roadless	7%	7%
Heliotrope (5,196 Acres, 4.7 Miles Existing Roads)		
Miles of New Road	1.1	0
Acres of Harvest	1,472	1,472
% of Roadless Area Affected	28%	28%
Muddy Creek-Nelson Mtn. (54,235 Acres, 22.5 Miles Existing Roads)		
Acres of Harvest	0	0
% of Roadless Area Affected	0%	0%
Twelvemile (10,600 Acres, 12.4 Miles Existing Roads)		
Miles of New Road	0	0
Acres of Harvest	29	29
% of Roadless Area Affected	.27%	.27%
White Mtn. (27,700 Acres, 8.6 Miles Existing Roads)		
Miles of New Road	0	0
Acres of Harvest	576	579
% of Roadless Area Affected	2%	2%
TOTAL DIRECT IMPACT TO INVENTORIED ROADLESS AREAS		
Miles of New Road	1.1	0
Acres of Harvest	2,542	2,542

Effects common to action alternatives specific to individual inventoried roadless areas are presented below.

Big Bear Canyon Inventoried Roadless Area

None of the alternatives would harvest or construct roads in the Big Bear Canyon inventoried roadless area. Consequently, there would not be direct effects to the roadless characteristics of this inventoried roadless area.

Apparent naturalness could be reduced indirectly from the effects of helicopter logging on adjacent, steep and consequently more obliquely apparent viewsheds as seen from within the Big Bear Canyon inventoried roadless area. From within the eastern-most area of Cove Mountain, the steeper slopes of Unit F3 would be fully visible and Unit F1 would be partially visible. Fortunately, the high ridge above Duck Fork Reservoir, between these units and the southern portion of the inventoried roadless area, would prevent longer views of these harvest areas.

Further away, high elevation helicopter logging should have no affect to naturalness or sense of remoteness. Variation in texture becomes obscured at longer distances and this harvest method avoids creating linear impacts. The negative visual effect associated with distant views of high, steep logged slopes would last only until the units were revegetated.

In summary, visitors using the Big Bear Canyon inventoried roadless area would perceive only moderate changes in the six roadless characteristics from visible activity within the northern portion of the project area.

Black Mountain Inventoried Roadless Area

The special features associated with Black Mountain and the scenic aspen basins would remain the same regardless of any action alternative.

There would be some indirect effect to apparent naturalness and a sense of remoteness from within this inventoried roadless area while viewing proposed harvest areas to the east. Although the view would be limited by the divide at Skyline Drive, visitors within the roadless area could see human-caused activity nearby.

Heliotrope Inventoried Roadless Area

As mentioned in Chapter 3, the Heliotrope Forest Plan inventoried roadless area was not carried through the RARE II evaluation process largely due to ease of vehicle accessibility and livestock use.

Manageability of the Heliotrope inventoried roadless area is already low due to past impacts and off road vehicle use. Additional access opportunities would further reduce the area's manageability. Special features are non-existent.

Heliotrope is relatively roaded. Forest Development Road #50022 on the northern border would be a major haul and traffic route for the project. Vehicle use of this road would have indirect audible effects near the entire northern margin of the inventoried roadless area.

Muddy Creek-Nelson Mountain Inventoried Roadless Area

None of the alternatives would harvest or construct roads in the Muddy Creek-Nelson Mountain inventoried roadless area. Consequently, there would not be direct effects the roadless characteristics of this inventoried roadless area.

Muddy Creek-Nelson Mountain inventoried roadless area is located far enough away or screened from adjacent potential development to preclude visual or audible affect to its roadless characteristics.

From within the Muddy Creek-Nelson Mountain inventoried roadless area, adjacent helicopter harvested slopes in Unit C1/2 could be seen from within the northwest corner of the roadless area. This indirect affect would potentially reduce one's sense of apparent naturalness, remoteness, and solitude.

Twelvemile Inventoried Roadless Area

Due to topography, the consequences of proposed harvest adjacent to the Twelvemile inventoried roadless area would not reduce its roadless characteristics.

White Mountain Inventoried Roadless Area

Due to topography and openness of vegetation, adjacent proposed harvesting outside of this inventoried roadless area in Units D2, D3 and D4/5 could be seen from within the White Mountain inventoried roadless area. This would have an indirect affect to the roadless characteristics of the area.

Effects Differing Between Alternatives 2, 3, and 4

The potential direct impacts to each inventoried roadless area for Alternatives 2 and 3 are shown in Figure 4-28 Inventoried Roadless Area Alternative 2 and 3. The potential direct impacts to each inventoried roadless area for Alternative 4 are shown in Figure 4-29 Inventoried Roadless Area Alternative 4.

Since Alternative 4 would not harvest or include road work within roadless areas, it would have no associated direct effects. Alternative 4 would have the same direct effects to roadless character as Alternative 1. Alternative 4 would have the same indirect effects to roadless character as Alternatives 2 and 3, due to visual and audible perceptions of unscreened, adjacent harvest activity (primarily higher elevation slopes). However, Alternative 4 would have the least amount of impacts to roadless character in comparison to the other action alternatives.

Effects differing between action alternatives specific to individual inventoried roadless areas are presented below.

Big Bear Canyon Inventoried Roadless Area

There would be no unique effects between the action alternatives to the Big Bear Canyon inventoried roadless area.

Black Mountain Inventoried Roadless Area

Both Alternatives 2 and 3 would harvest two units (G1 and G2) within the eastern margin of the Black Mountain inventoried roadless area. This activity could directly affect 7 percent of this inventoried roadless area. The amount of acreage directly affected by harvest could possibly reduce the Black Mountain's total size to 6,115 acres. This reduced acreage could move the area closer to the 5,000 acre minimum, thus increasing the potential for future conflicts related to manageability.

Except for a 39-acre difference in yarding methods, both Alternatives 2 and 3 would harvest Units G1 and G2 within the roadless area. Alternative 2 would yard 39 acres of G1 with ground-based equipment, whereas Alternative 3 would helicopter yard the 39 acres. This helicopter yarding would be somewhat less impacting to the area characteristics of apparent naturalness and remoteness.

Heliotrope Inventoried Roadless Area

Alternative 2

Alternative 2 includes four units (E1, E2, E3, E4) and 1.1 miles of road in the northwestern portion of this roadless area. Approximately 946 acres would be helicopter yarded and 526 acres would be ground-based yarded. Approximately 1,472 acres, or 28 percent of the total Heliotrope inventoried roadless area, would be directly affected by harvest.

Road density would increase from 0.58 to 0.74 miles per square mile, negatively affecting the area's roadless character.

Due to the small size of this roadless area (5,196 acres), direct impacts from harvest and roading would reduce the area of undeveloped character to less than the 5,000-acre minimum eligibility. This amount does not include the acres subject to indirect or cumulative effects as seen from above Emery Reservoir.

Indirect visual effects to roadless characteristics in this area from other adjacent lands planned for ground based yarding would not be apparent, except from the western margin above Emery Reservoir because of topography.

Alternative 2 would preclude future consideration of the Heliotrope inventoried roadless area for Wilderness designation.

Alternative 3

Alternative 3 includes four units (E1, E2, E3, E4) and road maintenance in the northwestern portion of this roadless area. All 1,472 acres would be helicopter yarded, potentially affecting 28 percent of its total roadless area directly.

Due to the small size of this entire roadless area (5,196 acres) this impact could possibly result in dropping the entire area's roadless designation because its undeveloped acreage could fall below the 5,000 acre minimum to 3,724 acres. This amount does not include the acres subject to indirect or cumulative effects as seen from above Emery Reservoir.

Road maintenance to Forest Development Roads #50070 and #50285 would also contribute towards a developed effect. However, road reclamation in the area should offset any negative effect associated with the upgrade of these haul roads.

As in Alternative 2, one would sense indirect visual and audible effects to Apparent naturalness and remoteness while in this area, relatively few helicopter harvested steep slopes would be apparent due to topography. The exception may be treatment units A1 and A3 as seen from the far western margin of the roadless area above Emery Reservoir.

Muddy Creek-Nelson Mountain Inventoried Roadless Area

There would be no unique effects between the action alternatives to the Muddy Creek-Nelson Mountain inventoried roadless area.

Twelvemile Inventoried Roadless Area

Alternatives 2 and 3 would harvest 29 acres within the southeast portion of the Twelvemile inventoried roadless area (Unit B4). Harvest of Unit B4 would directly affect less than 1 percent of this inventoried roadless area (approximately 0.27% would be affected). Given the size of this roadless area (10,600 acres) and the negligible direct impact, effects would be small. Potential impact from the small-scale of proposed harvest would not measurably affect the special feature of the existing large landslide or manageability of the area as a whole.

Alternative 2 would yard Unit B4 with ground-based equipment, whereas Alternative 3 would helicopter yard it. A difference in visual effects would be expected between the two types of yarding, with helicopter yarding leaving less visible evidence of activity.

White Mountain Inventoried Roadless Area

Both Alternatives 2 and 3 would harvest one unit (D4/5), totalling 576 acres, within the northeast part of the White Mountain inventoried roadless area. Harvest of Unit D4/5 would directly affect 2 percent of this inventoried roadless area. Given the size of this roadless area (27,700 acres) and the small direct impact of the proposed harvest, manageability of the remaining area should not be adversely affected.

Alternative 2 would yard 439 acres of Unit D4/5 with ground-based equipment and 137 acres with helicopter, whereas Alternative 3 would helicopter yard all this unit. A difference in visual effects would be expected between the two types of yarding, with helicopter yarding leaving less visible evidence of activity.

Unit D4/5 would be located within the viewshed of an outstanding lookout point, which is a special feature of this inventoried roadless area located near Three Lakes. The visibility of this unit from this special feature, would potentially affect apparent naturalness, sense of remoteness, and opportunity for solitude.

CUMULATIVE EFFECTS

Existing development associated with past harvest, mining, and user-developed roads located in or near roadless areas contribute to reducing roadless character.

The 1992 Timber Canyon Timber Sale (330 acres) was located within the Twelvemile roadless area, consequently there were direct effects to 3 percent of it. There may also be indirect effects to the characteristics of the roadless area. Those traveling to destinations nearby may view the harvested area. Others may simply know that it is there.

The 1993 Twelvemile Timber Sale (205 acres) was located approximately 7 miles west of the Heliotrope roadless area, accordingly it had no direct effect to it. Its indirect effects are negligible because it is not readily seen from any other roadless area.

From the 1996 South Manti Timber Salvage Sale decision, approximately 2,000 acres of timber have been or will be harvested within the next 3 to 5 years within the project area. This harvest may indirectly affect the area's roadless character in terms of apparent naturalness and remoteness due to noise and the presence of management activities in distant views.

FIGURE 4-28

Inventoried Roadless Areas Alternatives 2 & 3

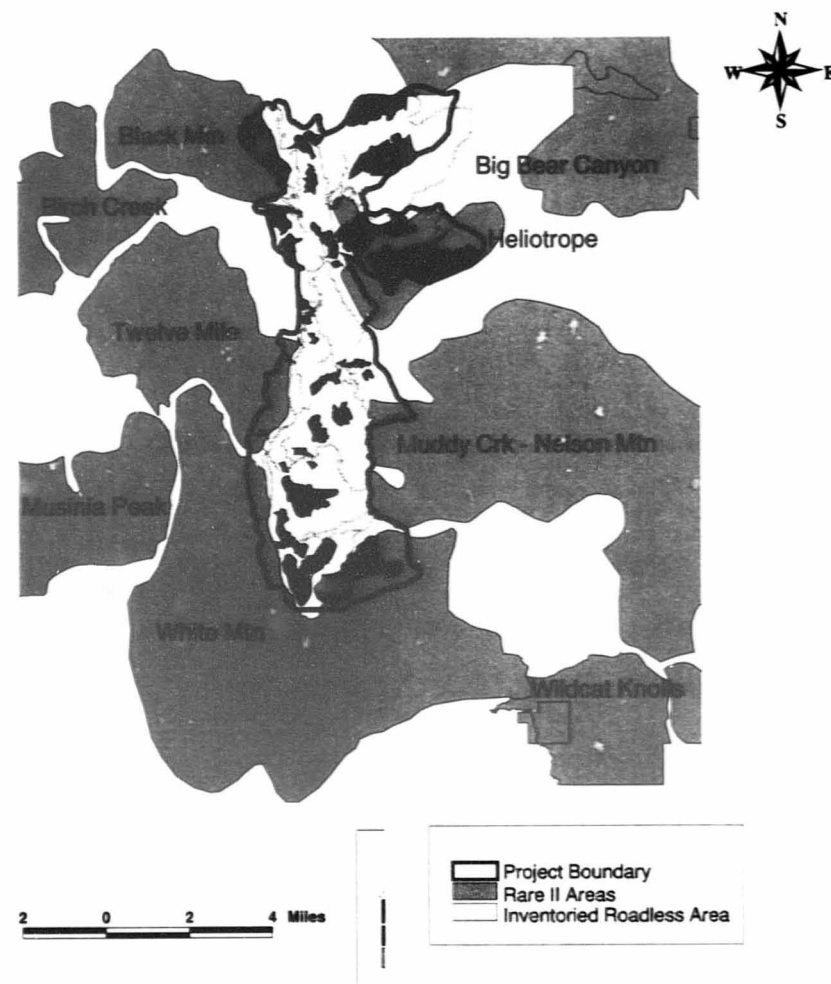
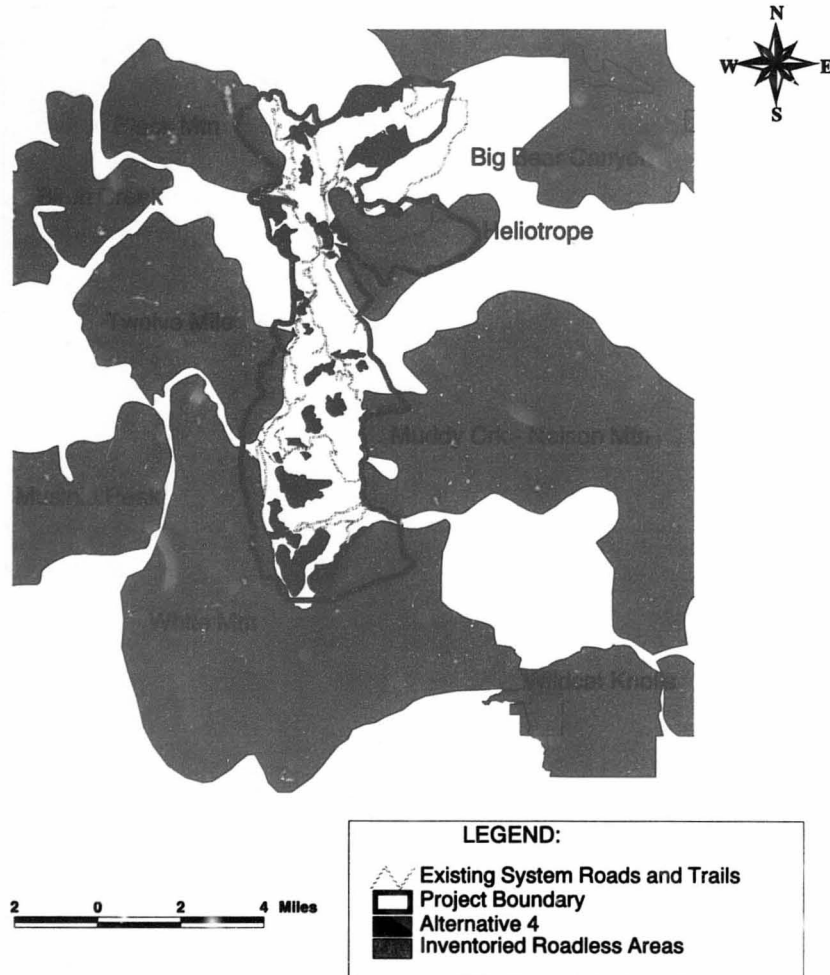


FIGURE 4-29

Inventoried Roadless Areas Alternative 4



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4.16 POTENTIAL CONFLICTS WITH PLANS AND POLICIES OF OTHER JURISDICTIONS

Possible conflicts with plans and policies of other jurisdictions, such as the State of Utah or local Counties, have been considered and are summarized in the following.

Prescribed burning has the potential to affect local air quality. This activity would be conducted in accordance with the 1989 Memorandum of Understanding with the State of Utah Air Conservation Committee and the Manti-La Sal Smoke Management Guidelines for Prescribed Fire (USDA Forest Service, 1992a). Past prescribed burning has not resulted in conflicts between the National Forest management goals and the commitments of the State Agencies for clean air. Sources of potential conflict exist between private landowners, State land management agencies, and other adjoining National Forests competing for the limited number of suitable burning days.

AIR QUALITY

LAND STABILITY

There would be no conflicts with plans and policies of other jurisdictions since roads would be located, designed, and constructed to minimize the potential for inducing landslides.

SOILS

There would be no conflicts with plans and policies of other jurisdictions.

WATER RESOURCES

Section 313 of the Clean Water Act requires Federal Agencies to comply with all Federal, State, interstate and local requirements, administrative authority, and process and sanctions with respect to the control and abatement of water pollution. Executive Order 12088 also requires the Forest Service to meet the requirements of the Act. All alternatives would comply with the Clean Water Act and State Water Quality Standards. These alternatives would incorporate reasonable Best Management Practices, avoid channel degradation, and comply with the Forest Plan.

Degradation of aquatic habitats would be in conflict with the plans and policies of the Utah Division of Wildlife Resources. Potential water-related effects are negligible relative to the existing hydrologic impacts from the beetle infestation. None of the alternatives would degrade aquatic habitats. Therefore, there would be no conflicts with plans and policies of other jurisdictions.

Current policies of Utah Division of Wildlife Resources direct that fishing opportunities be maintained or improved. New and improved road access to some areas could increase angler harvest success and fishing opportunities, complementing this other agency's policy.

VEGETATION RESOURCES

There would be no conflicts with plans and policies of other jurisdictions. Currently there are cooperating documents with Sanpete County for weed control.

FUELS/FIRE

Conflicts may arise if a planned fire or wildfire goes onto lands not administered by the Forest Service.

WILDLIFE RESOURCES

The Forest Service and the Utah Division of Wildlife Resources work together to manage wildlife, but the missions of the two agencies are different. The Forest Service manages the land and affects wildlife through the habitat provided - including access impacts. The State of Utah manages wildlife populations by adjusting hunting seasons and bag limits. There would be no conflicts with plans and policies of other jurisdictions.

TRANSPORTATION

There would be no conflicts with plans and policies of other jurisdictions. The final decision resulting from this planning effort would be in compliance with Agency road policy in effect at the time of the decision.

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RANGE ALLOTMENTS AND IMPROVEMENTS	There would be no conflicts with plans and policies of other jurisdictions.
VISUAL LANDSCAPE	There would be no conflicts with plans and policies of other jurisdictions.
UNDEVELOPED CHARACTER	There would be no conflicts with plans and policies of other jurisdictions.
CULTURAL RESOURCES	Cultural resource protection on Federal Lands are governed by the State Historic Preservation Office (SHPO), who serves in an advisory capacity. The policies of the Forest Service and SHPO are consistent.
ECONOMICS	There would be no conflicts with plans and policies of other jurisdictions.
ENERGY	There would be no conflicts with plans and policies of other jurisdictions.
ROADLESS CHARACTER	There would be no conflicts with plans and policies of other jurisdictions.
4.17 PROBABLE ENVIRONMENTAL EFFECTS THAT CANNOT BE AVOIDED	Implementation of any alternative would inevitably result in some environmental effects that cannot be avoided. The severity of the probable effects is minimized by adhering to the design features of the alternatives. Probable environmental effects that cannot be avoided have been considered and are summarized below. The earlier sections of this chapter addresses in detail potential effects.
AIR QUALITY	Temporary impacts to air quality are unavoidable from prescribed burning and associated smoke. Prescribed burning is an integral part of fuel treatment and site preparation for reforestation. Such activity would be scheduled when air dispersion is good. If a wildfire were to occur, there would be unavoidable effects to air quality from smoke. Such a wildfire could occur when air dispersion is poor.
LAND STABILITY	Increased potential for landslides caused by beetle-induced tree mortality cannot be avoided. It is not likely that this alternative could be implemented without the discussed effects in Section 4.2 of this Chapter.
SOILS	There would likely be some localized areas of soil damage from soil disturbance, erosion, or fire. The extent of damage would be negligible through the application of Best Management Practice. If an intense wildfire occurred, the soil resource would be unavoidably damaged.
WATER RESOURCES	Average water yield increases due to beetle-induced mortality of spruce trees would probably exceed ten percent for several of the subwatersheds (Duck Fork Creek and Little Horse Creek in the Ferron Creek Drainage and Greens Hollow, Mill Fork, Black Fork, Emerald Creek and North Fork of Muddy Creek). This average water yield would likely to cause an adjustment of the channels which would be expected to erode stream beds and banks, and increase the sediment loading. Timber harvest would not notably change this scenario. Although Best Management Practices would be used to minimize impacts to the soil and water resources, some small amounts of sediment could reach the stream channel. These amounts would not be expected to affect existing water uses. Aquatic habitat is in close proximity to proposed harvest activities. Some changes in watershed character, stream flow yields, and aquatic habitat are unavoidable. Riparian buffer zones and transportation design would minimize, and in most cases avoid, such disturbances.

VEGETATION RESOURCES	Existing spruce mortality and subsequent beetle-induced spruce mortality as spruce beetle populations continue to expand cannot be avoided. Spruce mortality is expected to continue, unless a natural environmental event (e.g. extreme cold, wet summer or heavy freeze affecting susceptible stages of the spruce beetle life cycle) causes a population collapse stopping the current epidemic.
FUELS/FIRE	Increased potential for wildfires cannot be avoided due to the degree that spruce stands within and adjacent to the project area have been killed creating an inordinate amount of fuel loading.
WILDLIFE	The probable environmental effects that cannot be avoided for each species are discussed in Section 4.7 of this chapter. All of the action alternatives would have an effect on the cover/forage relationships in the project area. Alternatives that require road building could possibly provide improved access during the hunting season. Thus, habitat security could be reduced and big-game vulnerability could be increased in all action alternatives.
TRANSPORTATION	Roads constructed and maintained for long-term use essentially become part of the landscape, affecting users and use of the area. Road construction, reconstruction, and obliteration directly affects various resources through ground disturbance. Road construction, reconstruction, and obliteration indirectly affect other resources through the change in use patterns.
RANGE ALLOTMENTS AND IMPROVEMENTS	Temporary effects to the availability and use of rangelands would be expected. Impacts would be the greatest for areas needing protection to ensure regeneration success. Range improvements would be protected.
VISUAL LANDSCAPE	Roads associated with the project which are maintained for long-term use would visually alter the landscape by the introduction of a linear feature - the road. Visual effects resulting from harvest activities would be relatively short-lived and blend in over time with the natural setting at the landscape scale. The introduction of timber harvest units would add a variety of line, form, color, and texture to the landscape. Recreation visitors would see a modified forest in the near foreground, middle-ground, and background where harvest and road construction is implemented.
UNDEVELOPED CHARACTER	Implementation of any action alternative cannot avoid affecting some Undeveloped Character across the project area.
CULTURAL RESOURCES	Some ground-disturbing activity may affect an undiscovered historic or prehistoric site. Sites discovered in this manner would be immediately protected from further disturbance. No effects are anticipated which cannot be avoided or mitigated through implementation of an approved data recovery/mitigation plan.
ECONOMICS	Although not an environmental effect, if funds are generated from the sale of timber, a percentage of the gained revenue would be apportioned to the affected Counties.
ENERGY	All action alternatives would consume fuels proportional to the number of engines (vehicles and other machinery) operating to implement the project.
ROADLESS CHARACTER	Implementation of any action alternative cannot avoid affecting the roadless character of the inventoried roadless areas to some degree.

**4.18 RELATIONSHIP
BETWEEN
SHORT-TERM USE
AND LONG-TERM
PRODUCTIVITY**

Short-term use is defined to be generally less than one year. Long-term productivity is generally considered to be more than 10 years. These time frames may vary by resource topic/issue and are defined in the text. Relationships between short-term use and long-term effects and/or productivity have been considered and are summarized below.

AIR QUALITY

The temporary impacts of smoke from prescribed burning and road dust from vehicles associated with activities would have minor, short-term effects on visual quality and recreation use. The short-term impacts are traded for by minimizing the risks from wildlife and long-term, increased site productivity.

LAND STABILITY

Effects on land stability would be long-term. They would last until the beetle-killed trees are replaced by natural regrowth. Without treatment, this would take 30 to 100 years for this to occur, depending on site specific conditions. Existing roads, including those portions of roads that are reconstructed for the project, would remain indefinitely. New project roads used in the action alternatives would exist for the life of the Timber Sale and follow-up reforestation efforts (estimated at 10 years). After serving these purposes, they would be rehabilitated. Rehabilitation could decrease the landslide potential. In the treated units, successful reforestation of understory vegetation would take approximately 5 years. Re-establishment of mature trees would take at least 30 years. In terms of land stability, changes in slope configuration that could decrease stability would be permanent. Replacement of tree root systems to provide soil support and decrease soil moisture would not take place.

SOILS

The predicted soil erosion rates are within soil loss tolerance limits to maintain long-term soil productivity. Soils would be taken out of production where nonproductive use is dedicated for roads, landings, and service areas. Upon rehabilitation the soils would again be productive. Adequate amounts of organic materials would be left for nutrient cycling and surface protection. The 10 to 15 tons per acre of coarse woody debris to be retained is consistent with requirements found in research, (USDA Forest Service, Graham et. al. 1994a). Soil compaction from ground-based logging that is not treated would return to its near natural density in a few years (estimated within 5 years). If an intense wildfire were to occur, long-term productivity would be considerably reduced.

WATER RESOURCES

Stream channel conditions may be altered as a consequence of short-term direct and indirect effects of management activities. Erosion and sedimentation from road development and increased peak flows may occur even after vegetative recovery, although at a lesser degree than initially. These water yield and sedimentation effects are long-term because they may not fully recover to natural rates. The impacts to aquatic habitat will be short term (less than ten years). Recovery will be dependent upon re-establishment of vegetation on disturbed areas and frequency, timing, and intensity of precipitation events.

**VEGETATION
RESOURCES**

Soil and water are considered to be the primary factors of productivity and a stands associated ability to produce vegetation. Regardless of short-term uses or non-uses proposed under individual alternatives, long-term productivity of soils and associated potential to grow trees within individual stands will be maintained through implementation of project design features described in Appendix D. Managed stands produce a higher volume through time than unmanaged stands. Regeneration of desired fast growing species, planting of genetically selected trees, stocking control to reduce competition and improve growth of individual trees, and intermediate treatments to maintain the health and vigor of stands are silvicultural means of maintaining the long-term yield of forest stands. In the short term, harvesting dead and dying trees captures volume that would otherwise be lost. Timely reforestation puts the land back into a productive timber

growing condition. There would be no effect to Federally listed plant species negligible effects on sensitive plant populations

FUELS/FIRE

In the short term (1-3 years) an increase in dead and down fuels, mixed with the fuel moisture characteristics mentioned previously, would contribute to an increase in fire risk. However, reducing the buildup of activity created fuels, by implementing slash disposal requirements described previously, and breaking up continuous fuels within designated treatment areas would reduce the overall wildfire risk to manageable levels. This practice would contribute to the long term (>25 years) reduction in risk of stand replacement due to wildfire.

WILDLIFE RESOURCES

For all action Alternatives relationship between short-term use and long-term productivity concerning each species are discussed in Section 4.7.

TRANSPORTATION

In the short term, traffic flow would be interrupted by limited passing facilities, slowed by the road condition and volume of traffic, or temporarily halted for construction activities. This holds true for the long term as well, however the effects are reduced due to a reduction in timber related vehicles traveling the roads. The transportation system would have a short-term increase in road density. The long-term effect is a decreased road density from 2.4 to 1.8 miles per square mile. Forest road users will need to pass approximately 2 additional logging-related vehicle every hour of travel for the 6 years of the operation. Long-term travel delays would decrease due to road improvement and maintenance.

**RANGE ALLOTMENTS
AND IMPROVEMENTS**

Over the short term, areas restricted for regeneration would reduce available forage for livestock. In the long term, when such areas no longer need protection and are returned to use, vegetative trends and production should be improved above the existing condition until stand density increases and reduces forage production.

VISUAL LANDSCAPE

There would be benefits to texture and color in the short term by removing dead and dying spruce. However, this short-term gain may be offset in the longer-term by more permanent visual impacts.

**UNDEVELOPED
CHARACTER**

Short-term use of the area could have long-term effects on the Undeveloped Character. Although in ecological time, the development associated with the action alternatives would eventually be unnoticeable (particularly vegetative change). Effects associated with road building can be relatively permanent.

**CULTURAL
RESOURCES**

Cultural resources which cannot be avoided by short-term uses would be subject to scientific excavation. While this would remove the resource and decrease future research opportunities, the excavation would be conducted to professional standards thereby resulting in appropriate recovery and documentation. The information obtained from excavation could provide long-term interpretation opportunities. Overall, effects to the existing knowledge of cultural resources for the Wasatch Plateau Region would be minimal.

ECONOMICS

The creation of short-term revenues through the sale of timber would not affect long-term productivity of the site. The corresponding impact of increased employment and associated income is expected to be short term, about six years.

ENERGY

Fuels would be used in the short-term for all of the action alternatives to develop access, harvest timber, haul timber to mills, and administer the project. This limited short-term use would not affect overall long-term productivity.

**ROADLESS
CHARACTER**

In ecological time, the short-term use associated with the action alternatives would eventually be unnoticeable, or at minimum blend the existing condition. Inventoried roadless area acreage affected by this project could be dropped, in part or whole, for future consideration as an inventoried roadless area.

**4.19 IRREVERSIBLE
AND
IRRETRIEVABLE
COMMITMENTS OF
RESOURCES**

Irreversible refers to the loss of future options - once executed, it cannot be reversed. Irreversible is primarily relevant to the extraction or use of renewable resources, such as minerals, cultural resources, or soil productivity. An irretrievable commitment of resources refers to the loss of production or use of natural resources for a time. For example, timber production is lost irretrievably while an area is serving as a winter ski area. The production is irretrievable, but the action is not irreversible. If the land use changes, it is possible to resume production. Irreversible and irretrievable commitments of resources have been considered and are summarized below.

AIR QUALITY

Smoke from prescribed burning, emissions from equipment, and road dust would have temporary seasonal impacts on the air quality in all action alternatives.

LAND STABILITY

Increases in landslide potential caused by human activity would be irretrievable but probably not irreversible because actions could be taken to increase land stability. The occurrence of a naturally occurring landslide could be irreversible. The occurrence of a project induced landslide could be reversible if limited in scale. Decreases in land productivity and water quality due to landslides would be irretrievable but not irreversible because actions could be taken to replace productivity. The loss of vegetation and soil due to a project induced landslide would be irretrievable. Landslide caused sediment increases in streams, ponds, and reservoirs would also be irretrievable. The loss of topsoil could be considered irreversible because replacement of soils by natural processes is very slow

SOILS

Best Management Practices would be used to avoid soil and potential productivity losses from timber harvest and associated access needs. Soil lost by erosion would be considered irretrievable. In general, the soil lost by this project would not cause an irreversible impact because the amount lost would be less than the amount of natural soil formation required to maintain long-term productivity. Soil productivity is irretrievably lost to road construction that is not rehabilitated.

WATER RESOURCES

Water yield increases from any of the alternatives are irreversible and irretrievable for 30 years. Water yield increases would alter the channels of seven streams. Sediment from these sources would move downstream. There are no irreversible or irretrievable commitments of riparian, wetland or floodplain resources. There are no irreversible or irretrievable effects anticipated to aquatic habitats or species.

**VEGETATION
RESOURCES**

Mortality of spruce trees affected by spruce beetle is an irreversible effect that cannot be avoided. A minimum of 100 to 200 years would be required to bring stand structures back to conditions similar to those which existed prior to the spruce beetle epidemic. Timber harvest would change plant succession, stand development, and species composition. No effects are anticipated to cause irreversible commitments of rangeland resources. If project requirements fail, some irretrievable commitments may include loss of vegetation for livestock and wildlife if noxious weeds become established. Also some diversity in vegetative composition of the plant community could be lost to noxious weeds. Road construction would irretrievably remove land from production. The impact to sensitive plant populations is expected to be minimal.

FUELS/FIRE

Resources could be irretrievably lost if an intense wildfire were to occur.

WILDLIFE RESOURCES

The loss or modification of habitat for certain wildlife species is an irreversible commitment of resources. As vegetation recovers, this habitat would recover. No irreversible commitment of resources would occur from implementation of any alternative. Irretrievable commitments would occur when the annual productivity of the various species is reduced.

TRANSPORTATION

The area needed for road construction and gravel sources takes that land out of production and is an irretrievable commitment. Removal of the gravel is an irreversible commitment. The time spent by travelers because of delay or extended travel time is irreversible and irretrievable.

**RANGE ALLOTMENTS
AND IMPROVEMENTS**

No irreversible commitments of resources are expected. Irretrievable commitments include a temporary damage to range improvements until they are repaired and temporary loss of forage production during initial reforestation of the harvested areas.

VISUAL LANDSCAPE

No action would cause no irreversible or irretrievable effects to visual quality in the long term. Changes in the existing appearance of the landscape would occur from the action alternatives. These changes are reversible because they would become progressively less noticeable as vegetation recovered in harvested areas and along roads. Additionally, until full visual recovery, reductions of visual quality from timber harvest itself would be offset by an improvement to the landscape color and texture associated with the removal of the dead and dying trees. Roads and their associated cut and fill slopes represent a potential irretrievable reduction to the visual quality because they may never be reclaimed to the extent that they are wholly not recognized as being unnatural.

**UNDEVELOPED
CHARACTER**

Within our human context or time frame, Undeveloped Character is essentially a non-renewable resource. Most development is an irretrievable and irreversible commitment of the resource to a less natural condition for the long-term because the processes of ecological recovery and succession move slowly compared to a human life span. In a broader time frame the developed condition may be reversible after about 100 years.

**CULTURAL
RESOURCES**

Any activity that would disturb a cultural resource is an irreversible commitment. While the recovered data could be used for educational purposes, the removed portion of the site would be irretrievably lost.

ECONOMICS

Implementation of Alternative 1 could have the irreversible economic effect of forgone employment opportunities and revenue generation once the dead trees become unmerchantable.

ENERGY

The use of fossil fuels to implement any of the action alternatives would represent irreversible and irretrievable commitments of resources.

**ROADLESS
CHARACTER**

There would be no irreversible or irretrievable commitment of resources with implementation of Alternative 1. Impacts to Roadless Character is essentially a non-renewable resource. Most development is an irretrievable and irreversible commitment of the resource to a less natural condition for the long-term because the processes of ecological recovery and succession move slowly compared to a human life span. In a broader time frame the developed condition may be reversible after about 100 years.

4.20 FOREST PLAN CONSISTENCY

This project tiers to direction in the Forest Plan and its Record of Decision, and incorporates by reference the analysis disclosed in its environmental analysis. This planning effort documents the analysis in the second level of planning.

In the Forest Plan, the National Forest System lands within the Manti-La Sal National Forest has been divided into management units which differ from each other in resource emphasis. The management units that fall within the project area were discussed and mapped in Chapter 3 of this document. Changes in land use designation which have been established in the Forest Plan are not part of this project and were not evaluated in this analysis.

Forest Plan Forestwide direction is presented in Appendix C - Forest Plan Direction. Forestwide direction applies to all areas across the Forest. Additional Forest Plan direction applicable to the pertinent management units is also presented in Appendix C - Forest Plan Direction. Management unit direction is supplemental to and supersedes the general Forestwide direction.

Disclosures within this document and Project File support that all action alternatives considered in detail would be consistent with Forest Plan direction. A detailed assessment of consistency for each resource area can be found in the Project File.

The following disclosures summarize specific project consistency with the Forest Plan. This summary is intended to be fairly inclusive of applicable key direction by resource/issue topic. However limiting the following examples may be, consistency was assessed on the entirety of the Forest Plan direction.

AIR QUALITY

All alternatives would be consistent with Forest Plan direction. They would comply with Forestwide direction to meet State and Federal air quality objectives (Air Quality 01). Consistency is based upon compliance with the 1988 Memorandum of Understanding with the State of Utah Air Conservation Committee and the Forest Service and use of the Manti-La Sal Smoke Management Guidelines for Prescribed Fire (USDA Forest Service, 1992a). There is no Range or Wood-fiber Management Unit direction regarding air quality.

LAND STABILITY

All alternatives would be consistent with Forest Plan direction. They would comply with Forestwide direction to conduct appropriate geologic surveys and include appropriate geological data into the project (Geologic Resources Management 01, 02). Examples of consistency include the land stability analysis completed for this project and project requirements to: reforest harvested areas; operate under dry or frozen condition; avoid locating log decks in existing landslide areas; and avoid, where practical, unstable areas, moderately unstable areas, slopes greater than 40 percent, and active landslides. There is no Range or Wood-fiber Management Unit direction regarding land stability.

SOILS

All alternatives would be consistent with Forest Plan direction. They would comply with Forestwide direction to conduct appropriate soil inventories, maintain and improve soil productivity, minimize project impacts to the soil resource, and rehabilitate disturbed areas (Soil and Water Inventories 01; Soil and Water Resource Management 01, 02; Soil and Water Resource Improvements 01). Examples of consistency include the soil resource analysis completed for this project and project requirements to: helicopter or cable yard steep slopes; reforest harvested areas; operate under dry or frozen condition; maintain 10 to 15 tons per acre of woody debris; apply Best Management Practices; scarify severely compacted areas, use erosion control measures for road construction, prescribe burn in a manner to not adversely impact the soil resource, and reclaim specified roads. There is no Range or Wood-fiber Management Unit direction regarding soils.

WATER RESOURCES

All alternatives would be consistent with Forest Plan direction.

Water Quantity: All alternatives would comply with Forestwide direction to analyze the implementation of projects on water yield, and secure and maintain instream flows to protect resources and uses (Water Yield Improvement 02; Water Uses Management 01, 03). Water yield has been analyzed for this project, it is expected to negligibly increase as a result of the action alternatives. Current and future water yields are predominantly associated with the beetle-caused tree mortality. Examples of consistency are the same as those listed in the preceding soils section. There is no Range or Wood-fiber Management Unit direction regarding water quantity.

Water Quality: All alternatives would comply with Forestwide direction to improve or maintain water quality, implement Best Management Practices, and manage waters capable of supporting self-sustaining fisheries (Water Quality Management 01, 02; Wildlife and Fish Resource Management 08). Water quality has analyzed for this project. The only water quality parameter that would be affected by the action alternatives is total suspended solids (sediment). It was found that changes to sediment would be small and beneficial uses would not be adversely affected. Examples of consistency include those listed in the preceding soils section. Additionally, consistency is exhibited by project requirements to: place logging slash and large woody debris on skid trails, conduct field review to refine appropriate Best Management Practices; stabilize and reseed helicopter landings, and include contractual provisions to minimize the risk of petroleum products entering the water. There is no Range or Wood-fiber Management Unit direction regarding water quality.

Riparian, Wetlands, And Floodplains: All alternatives would comply with Forestwide direction to identify and evaluate effects to riparian, wetlands, and floodplains (Riparian, Floodplain and Wetlands 01, 03). Identification and analysis of potential impacts to these water-dependent features has occurred for this project. Other examples of consistency include project requirements to: exclude harvest and ground-based harvest equipment within 100 feet of perennial waters and 50 feet of intermittent waters, unless otherwise approved for specific crossing; avoid road and landing construction within riparian areas where possible; cross Riparian Units perpendicular; obtain specific approval for landings within Riparian Units; avoid wetlands where possible, and rehabilitate them where avoidance is not possible; restore skidding-induced changes to the drainage; minimize road crossing in wetlands; field identify floodplains and assess appropriateness of facility location; and apply Best Management Practices. There is no Range or Wood-fiber Management Unit direction regarding these water-dependent features.

Aquatic Habitat: All alternatives would comply with Forestwide direction to provide habitat needs, as appropriate, for management indicator species (Wildlife and Fish Resource Management 01). The above water resource discussions demonstrate consistency with this requirement. Additionally, consistency is demonstrated by the project requirements to: maintain the macroinvertebrate diversity index at or above 11, and the biotic condition index at or above 75; conduct field review of all perennial streams to assess and determine appropriate fish passage structures (e.g. culverts); and manage stream habitat to at least 50 percent of its potential. There is no Range or Wood-fiber Management Unit direction regarding aquatic habitat.

Threatened, Endangered, and Sensitive Aquatic Species: All alternatives would comply with Forestwide direction to manage habitat for recovery of threatened and endangered species, and manage habitat of sensitive species to keep them from becoming listed (Wildlife and Fish Resource Management 02, 04). Although no such species occur within the project area, the above water resource discussions demonstrate consistency with this requirement. There is no Range or Wood-fiber Management Unit direction regarding threatened, endangered, and sensitive aquatic species.

VEGETATION
RESOURCES

All of the action alternatives would be consistent with Forest Plan direction. It could be debated as to whether inaction, Alternative 1, would be consistent with specific vegetation management direction.

Forest Health, Diversity, and Productivity: All action alternatives would comply with Forestwide direction to: manage suitable timberlands for harvest; provide for timber stand improvement, reforestation and wildlife habitat improvement; manage unsuitable timberlands for commercial harvest to maintain forest cover species, with emphasis on other forest resources and use; use clearcuts as appropriate on any forest species with potential for impact, or impacted by insects or disease; manage timber product removal and utilization to meet multiple use requirements; establish satisfactory reforestation after harvest (Timber Resource Management 01, 02, 03, 04, 05; Silvicultural Prescriptions 03; Reforestation 01). The need to treat extensive dead and dying spruce is the foundation of this project, and its action alternatives. All action alternatives propose a selective harvest to recover only dead and dying spruce trees. Although the overall proposed treatment is a selective salvage harvest, there would be some small openings representative of clearcut openings (less than 40 acres in size). The need for treatment addressed by the action alternatives has incorporated management for current and future harvest opportunities, forest cover maintenance, timber stand improvement, wildlife habitat improvement, and emphasis on multiple uses. All action alternatives include measures to ensure adequate reforestation. While all of the action alternatives are directly responsive to the aforementioned direction, it could be debated as to whether inaction, Alternative 1, would be consistent. There is also Range Management Unit Direction to maintain forests to provide a high level of forage production, wildlife habitat, and diversity (Range, Timber Resource Management 01). As stated above, all action alternatives would be consistent with this, whereas it could be debated as to whether inaction, Alternative 1, would be. There is no Wood-fiber Management Unit direction regarding forest health, diversity, and productivity.

Noxious Weeds: All alternatives would comply with Forestwide direction to control and reduce noxious weeds (Range Improvement and Maintenance 03). Examples of consistency include project requirements to continue control of noxious weeds and require weed-free equipment prior to moving onto the site. There is also Range Management Unit Direction to improve or maintain range condition to fair or better (Range, Range Resource Management 01). Continued weed management and preventative measures such as weed-free equipment would help maintain the range condition. There is no Wood-fiber Management Unit direction regarding noxious weeds.

Threatened, Endangered, and Sensitive Terrestrial Plant Species: All alternatives would comply with Forestwide direction to manage habitat for recovery of threatened and endangered species; manage habitat of sensitive species to keep them from becoming Federally listed (Wildlife and Fish Resource Management 02, 04). There are no proposed Federally listed plants, or their habitat, within the project area. Heliotrope milkvetch, the only threatened plant within the project area, is outside of the areas of activity and would not be affected. There would be no impact to the endangered species Carrington daisies or Arizona willow because they outside of the areas of activity and would not be affected. There may be cumulative impacts to Musine groundsel and Maguire campion associated with use of the South Camel gravel pit and ongoing non-project crushed gravel at the North Camel gravel pit. However, project requirements are included to minimize potential impacts and the crushed rock surface afterwards may provide habitat conducive to plant establishment. Additionally, consistency is demonstrated by project requirements to minimize or avoid potential effects; do not harvest within riparian zones, survey habitats and known populations sites prior to harvest; and identify and protect plants and habitat. There is no Range or Wood-fiber Management Unit direction regarding threatened, endangered, and sensitive terrestrial plant species.

FUELS/FIRE

All of the action alternatives would be consistent with Forest Plan direction. It could be debated as to whether inaction, Alternative 1, would be consistent with specific vegetation management direction. All action alternatives would comply with Forestwide direction to: provide a level of protection from wildfire that cost efficient that should meet objectives of the management unit, maintain fuel conditions which permit fire suppression forces to meet protection objectives of management unit, use preplanned prescribed fire to accomplish resource management objectives (Fire Planning and Presuppression 01; Fuel Treatment 01; Vegetation Treated by Burning 01). The need to treat the extensive amount dead and dying spruce is the foundation of this project, and its action alternatives. All action alternatives propose to selectively harvest dead and dying spruce trees followed by fuel treatments (prescribed burning, lopping and scattering, fuel breaks) to reduce fuels and wildfire potential. The proposed method of treatment may be the most cost-effective means to achieve the desired reduced fuels and wildfire risks. All action alternatives should result in conditions within the capabilities of fire suppression efforts. While all of the action alternatives are directly responsive to the aforementioned direction, it could be debated as to whether inaction, Alternative 1, would be consistent.

WILDLIFE RESOURCES All alternatives would be consistent with Forest Plan direction.

Management Indicator Species: All alternatives would comply with Forestwide direction to: provide habitat needs, as appropriate, for management indicator species; and manage down timber to provide habitat for wildlife; maintain or improve habitat capability; and use commercial and non-commercial practices to accomplish wildlife habitat objectives (Wildlife and Fish Resource Management 01, 07; Wildlife Habitat Improvement and Maintenance 01, 04). Several project requirements demonstrate consistency: maintaining adequate cover in calving areas, promoting aspen clones where they exist in treated areas, precluding harvest during calving and fawning periods, restricting harvest activities during the hunting season; closing temporary project roads to the public, maintaining appropriate forage to cover ratios; maintaining at least 50 percent of current habitat; meeting specified log, slash, and woody debris requirements; protecting trees with raptor nest sites or snags; retaining specified number of snags; and restricting winter hauling if necessary. The action alternatives further contribute to achieving the Forest Plan direction by not harvesting live tree non-spruce trees or dead Douglas-fir to improve cavity habitat, road closures and reclamation to improve habitat effectiveness, and reforestation to accelerate return of cover and security. There is no Range or Wood-fiber Management Unit direction regarding management indicator species.

Tree Cavity Dependent Species: All alternatives would comply with Forestwide direction to provide for habitat needs of tree cavity nesting birds, raptors, and small animals (Wildlife and Fish Resource Management 06). Project requirements that demonstrate consistency include requirements for leave trees, snag and raptor nest trees, and log/slash/woody debris. There is no Range or Wood-fiber Management Unit direction regarding cavity dependant species.

Proposed, Threatened, and Endangered Species: All alternatives would comply with Forestwide direction to manage habitat for recovery of threatened and endangered species, and maintain and/or improve habitat and habitat diversity for minimum viable populations (Wildlife and Fish Resource Management 02, 04). There would be no effect to endangered peregrine falcon and southwest willow flycatcher. Action alternatives may impact individuals or habitat, but would not likely contribute to a loss of population viability of proposed Canada lynx and threatened bald eagle. Impacts to lynx would be from possible indirect increased human activities in winter habitat. Impacts to bald eagle would be from possible disturbance from helicopter activity during migration through the area, although helicopter restrictions exist for roosting periods. There is no Range or Wood-fiber Management Unit direction regarding proposed, threatened, and endangered species.

TRANSPORTATION

Sensitive Species: All alternatives would comply with Forestwide direction to manage habitat of sensitive species to keep them from becoming Federally listed, and maintain and/or improve habitat and habitat diversity for minimum viable populations (Wildlife and Fish Resource Management 04, 05). The numerous above wildlife resource discussions demonstrate consistency with this requirement. Additionally sensitive species would be protected by: following Conservation Strategy and Agreement for the Management of Northern Goshawk; retaining large snags and small pockets of dense vegetation along ridge tops and mid-slope on south or east aspects; retaining snags, including ones with broken tops; Action alternatives may impact individuals or habitat, but would not likely contribute to a loss of population viability of sensitive wildlife species. There is no Range or Wood-fiber Management Unit direction regarding sensitive species.

Neotropical Migratory Birds: There is no Forestwide, Range, or Wood-fiber Management Unit direction specific to Neotropical migratory birds. However, the preceding discussions about wildlife indicate that the needs of such birds would be met by all alternatives.

All alternatives would be consistent with Forest Plan direction. All action alternatives would comply with Forestwide direction to: close newly constructed roads to public use after project use; allow permitted use of Forest Development Roads under specific requirements; close Forest Development Roads when unacceptable damage is occurring; construct and reconstruct arterial and collector road to meet multiple use; construct and reconstruct local roads specific uses (e.g. timber sales); construct temporary roads for specific activities (e.g. timber sales); Maintain roads to minimum requirements (Transportation System Management 01, 02, 06; Arterial and Collector Road Construction and Reconstruction 01; Local Road Construction and Reconstruction 01, 02; Road Maintenance). All action alternatives include road management as outlined above. It could be debated as to whether inaction, Alternative 1, would be consistent with the direction to close roads causing unacceptable damage. There is no Range Management Unit direction regarding transportation. Wood-fiber Management Unit direction is to plan roads to meet short- and long-term timber management needs, with emphasis to design that will benefit future timber activities (Wood-fiber, Transportation System 01, 02).

RANGE ALLOTMENTS
AND IMPROVEMENTS

All alternatives would be consistent with Forest Plan direction. All alternatives would comply with Forestwide direction to manage the range resource in harmony with other resources and activities (Range Resource Management 01). This project attempts to accomplish several needs in harmony for all resources involved. Additionally, the project includes coordination with the livestock permittee. The Range Management Unit direction regarding noxious weeds has been presented in the preceding noxious weed section. Wood-fiber Management Unit direction includes protecting regeneration from unacceptable livestock damage (Wood-fiber, Range Improvement and Maintenance 01). All action alternatives include provisions for regeneration protection from livestock damage.

VISUAL LANDSCAPE

All alternatives would be consistent with Forest Plan direction. All alternatives would comply with Forestwide direction that Forest uses should meet the adopted Visual Quality Objective, and to design and implement activities to blend with the landscape, and to achieve landscape enhancement through addition, deletion, or alternation of landscape elements (Visual Resource Management 01, 02, 04). The most pertinent areas would meet the Visual Quality Objectives of the area, with the selective nature of the project, removal of dead and dying trees, slope restrictions, reforestation, road reclamation, and design features such as feathering, leave areas, irregular openings, etc. Additionally, further field review would be made to identify visually sensitive areas to be included in the contract for special measures. There is no Range or Wood-fiber Management Unit direction regarding visual landscape.

UNDEVELOPED
CHARACTER

There is no Forestwide, Range, or Wood-fiber Management Unit direction specific to undeveloped character. However, the following Forestwide direction to provide opportunities for roaded, natural appearing, semiprimitive motorized, and semiprimitive nonmotorized recreation uses would apply (Dispersed Recreation Management 02). Additionally, Range and Wood-fiber Management Unit Direction to provide semiprimitive nonmotorized, semiprimitive motorized, roaded natural, and rural recreation opportunities (Range, Dispersed Recreation Management 01; Wood-fiber, Dispersed Recreation Management 01). The project area provides semiprimitive motorized, roaded natural, and rural Recreation Opportunity Spectrum classes. Additionally, there are areas where nonmotorized recreation could occur. The above discussion about visual landscape could also apply to the discussion of undeveloped character.

CULTURAL
RESOURCES

All alternatives would be consistent with Forest Plan direction. All alternatives would comply with Forestwide direction to protect cultural resources and use a predictive model to determine areas of probability for survey (Cultural Resource Management 01, 02, 03, 04). Examples of consistency include use of the predictive model and subsequent survey completed for this project and project requirements to: implement to Memorandum of Understanding with the State Historic Preservation Office; complete inventories; evaluate and protect National Register eligible sites; when protection in place is not possible, avoid, minimize, or mitigate impacts; when modification cannot protect site, develop data recovery plans; halt activities upon discovery of new sites, and consult with Native American entities. Additionally, a no effect determination has been made for all alternatives. There is no Range or Wood-fiber Management Unit direction regarding cultural resources.

ECONOMICS

There is no Forestwide, Range, or Wood-fiber Management Unit direction specific to economics. However, all action alternatives would meet Forest Plan Timber Goals to: provide commercial timber sales of sufficient quantity and quality to maintain local timber industry and accomplish desired vegetation treatment goals; meet as much of the demand for wood fiber and Forest products as possible, consistent with multiple-use objectives; and use timber management to meet other management or resource needs.

ENERGY

There is no Forestwide, Range, or Wood-fiber Management Unit direction specific to energy.

ROADLESS
CHARACTER

There is no Forestwide, Range, or Wood-fiber Management Unit direction specific to roadless character. The preceding discussions for undeveloped character and visual landscape would apply to roadless character.

4.21 SPECIFICALLY
REQUIRED
DISCLOSURES

Environmental Justice

The alternatives were assessed to determine whether they would disproportionately impact minority or low income populations, in accordance with Executive Order 12898. No local minority or low income populations were identified during scoping of the analysis of effects. No minority or low income populations are expected to be impacted by implementation of any of the alternatives.

Effects of Alternatives on Social Groups

There would be no overall differences between alternatives in effects on minorities, Native American Indians, women, or the civil liberties of any American citizen.

Effects on Floodplains and Wetlands

There are bogs, ponds, and lakes within the project area. These wetlands should not experience any significant adverse effects from management activities. The floodplains within the project area would not receive measurable impact by upstream influences. Management activities designed to protect these resources conform to the federal regulations for floodplains (Executive Order 11900) and wetlands (Executive Order 11990).

Energy Requirements and Conservation Potential of Alternatives

Energy consumption and output is presented in Section 4.14 of this Chapter. The energy required to implement the alternatives in terms of petroleum products would be insignificant when viewed in light of the production costs and effects of the national and worldwide petroleum reserves.

Effects of Alternatives on Prime Rangeland, Forest Land, and Farm Land

The alternatives presented are in compliance with Federal Regulations for prime lands. The project area does not contain any prime rangeland or farm lands. The definition of prime forest land does not apply to lands within the National Forests. In all alternatives, Federal lands would be managed with the appropriate consideration to the effects on adjacent lands.

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APPENDIX A

LIST OF PREPARERS

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APPENDIX A - LIST OF PREPARERS

Core Interdisciplinary Team

Name	Area of Expertise	Education	Experience (years)
Judy Beacco	Co-Team Leader, Writer/Editor	B.S. Forest Management B.S. Secondary Education	7
Martha DeFreest	Transportation Planning, Energy	B.S. Civil Engineering	7
Doug Jones	Team Leader	B.S. Forestry	19
Greg Montgomery	Forest Health, Vegetation, Silviculture	B.S. Forestry Certified Silviculturist	20 10
Steve Romero	Wildlife, Vegetation, Threatened and Endangered Species, Sensitive Species, Range	B.S. Wildlife Management	6

Extended Interdisciplinary Team

Name	Area of Expertise	Education	Experience (years)
Barb Blackshear	Cultural Resources	B.A. Anthropology M.A. Anthropology	8
Steve Cote	Logging Systems	A.S. Forestry	23
Rob Davies	Soils, Water, Riparian, Aquatic Habitat, Fisheries	B.S. Geology B.S. Fishery Biology	6
Kevin Draper	Visuals, Recreation, Roadless Character, Undeveloped Character	B.S. Wildlife and Range M.L.A. Landscape Architect	7
Ivan Erskine	Fuels, Fire, Air Quality	B.S. Forestry B.S. Elementary Education	23
Glen Jackson	Economics, Timber Sale Contract Administration	B.S. Forestry	29
Pete Kilbourne	Geographic Information Systems	B.A. Geology	16
Reta LaFord	Environmental Planning	B.S. Forest Resource Management	14
Steve Munson	Insects and Forest Health	B.S. Forest Pest Management M.S. Forest Entomology	25
Carter Reed	Geology, Land Stability	B.S. Geology	20

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APPENDIX B

PUBLIC INVOLVEMENT

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APPENDIX B - PUBLIC INVOLVEMENT

SCOPING

The solicitation of comments is referred to as scoping. Comments were sought on the Proposed Action as indicated below.

Date of Scoping	Type of Scoping
January 14, 1998	Manti-La Sal "Schedule of Proposed Actions" Forest mailed to an approximate 250-person mailing list.
February 17, 1998	Federal Register Notice of Intent (Vol. 63, No. 31) Distributed Nationally.
February 17, 1998	Individual Scoping Letters Individual scoping letters were mailed to approximately 300 individuals.
April 8, 1998	Manti-La Sal "Schedule of Proposed Actions" Forest mailed to an approximate 250-person mailing list.
July 24, 1998	Manti-La Sal "Schedule of Proposed Actions" Forest mailed to an approximate 250-person mailing list.
October 5, 1998	Field Trip Field trip to explain proposed action to interested publics and gain their input.
October 20, 1998	Manti-La Sal "Schedule of Proposed Actions" Forest mailed to an approximate 250-person mailing list.

CONTENT ANALYSIS

The process of analyzing scoping comments is called content analysis. Content analysis helps to clarify the project, set the limits for the analysis, and identify follow-up actions.

Twenty letters were received in response to scoping efforts for the Proposed Action. Received letters were assigned a unique number based on the date of the letter, see below.

Letter Date	Letter Number	Affiliation, Name, Address
11/7/97	1	Kaibab Industries, Inc., Deborah Campbell
12/30/97	2	Wild Utah Forest Campaign, Dave Nashland
2/19/98	3	Wildlife Management Institute, Len H. Carpenter
2/23/98	4	Western Ancient Forest Campaign, Amelia Jenkins
2/24/98	5	Sierra Pacific Industries
2/26/98	6	Inst. for Policy Research, Northwestern University, H. Paul Friesma
2/26/98	7	Sanpete County Commission, Robert D. Beesy
3/7/98	8	Gunnison Irrigation Company, Mandell Jensen
3/9/98	9	State of Utah, Division of Wildlife Resources, Miles Moretti
3/11/98	10	Central Utah Wildlife Association, Curtis Andersen
3/11/98	11	Mayfield Town Board
3/12/98	12	Mark Anderson, Jeff Anderson
3/12/98	13	Wayne Sorenson
3/18/98	14	Louisiana-Pacific Corporation
3/18/98	15	Southern Utah Wilderness Alliance, W. Herbert McHarg
3/18/98	16	Southwest Center for Biological Diversity, Brian Segee
3/23/98	17	Satterwhite Log Homes, Sam Satterwhite
3/25/98	18	U.S. Fish and Wildlife Service, Reed E. Harris
3/28/98	19	C. Jay Larson
4/2/98	20	Utah Farm Bureau Federation, John B. Keeler

The contents of each letter were assigned a sequential number within the letter. The Interdisciplinary Team reviewed and addressed the contents of each letter. Each comment was categorized thematically to better allow for synthesis of comments. Categorization included identification of topic, issues, features common to all alternatives, alternatives considered but dropped, alternatives to be further considered, items to be disclosed in the analysis, and other actions to be taken.

The comments presented are excerpts indicative of the overall comment. Some comments were of a general nature and did not warrant a response (e.g. restatement of the proposal, expression of favor or disfavor of the proposal). Such comments are correspondingly not further addressed. Each comment addressed has a narrative response and tracking summary. The tracking summary indicates the general topic of the comment and how the comment will be addressed through this project. The codes for the tracking summary are below.

General Topic of Comment/Tracking Summary	Issue (Nonsignificant)
	1. Air Quality
	2. Land Stability
	3. Soil Erosion and Productivity
	4. Water Resources
	5. Vegetation Resource
	6. Fuel Load and Fire Risk
	7. Wildlife
	8. Transportation System
	9. Range Allotments
	10. Visual Landscape
	11. Undeveloped Character
	12. Cultural Resources
	13. Economics
	14. Energy
	Issue (Significant)
	15. Roadless Area Character

How Comment Will Be Addressed

In	= Issue, nonsignificant, related effects will be disclosed.
Is	= Issue, significant, alternatives to the Proposed Action will be developed from.
Af	= Alternative feature to be common to all action alternatives.
Ac	= Alternative considered, to be reflected in an Alternative to the Proposed Action.
Ad	= Alternative considered but dropped from further consideration.
D	= The referenced item will be addressed and disclosed as part of the project.
O	= No further action to be taken.

Letter &

Comment Proposed Action Scoping Comment, Content Analysis, and Tracking Summary

COMMENTER: KAIBAB INDUSTRIES, INC.

1 - 1 **Comment:** Change of address notification. No project-specific comments.

COMMENTER: WILD UTAH FOREST CAMPAIGN

2 - 1 **Comment:** "... timbering, especially below cost timbering, is totally unnecessary on the Manti-La Sal."

Analysis: There is a cost in doing management activities. Often the costs of management are greater when additional measures are taken for resource protection and/or enhancement. Some benefits of management are quantifiable, others are not. Analysis and disclosure for this project will include

economic considerations and disclosure. The selected alternative may, or may not, reflect a "below cost" activity. There is no law, regulation, or policy applicable to the Manti-La Sal National Forest prohibiting below cost activities. Additionally, the purpose and need for the project extends beyond the recovery of some of the economic value of the dead and dying trees. The purpose and need includes reducing the potential for large and intense wildfires across forested areas (with associated environmental effects) and facilitating rapid reestablishment of Engelmann spruce through replanting of spruce in Timber Management Emphasis Units. Timber harvest is a tool that is responsive to the purpose and need for the project - it may be the most effective and efficient tool currently available.

Tracking: E - In #13, D.

COMMENTER: WILDLIFE MANAGEMENT INSTITUTE

- 3 - 1 **Comment:** "... it is imperative that the EIS thoroughly analyzes the needs and plans for roads in this project. This includes how the new roads will fit into the long-term transportation plan for the Forest. Details need to be given explaining how roads that are not needed after the project is completed will be closed."

Analysis: The need for and use of roads will be considered as part of this project. Forest Development Roads (system roads) will be managed for the needs of specific resource objectives after project completion. Project-constructed system roads not required for specific resource objectives will be closed and managed as maintenance level 1 or reclaimed. Temporary work roads for the project will be closed and returned to resource production after use. Other nonsystem roads not needed for future resource management will be closed as funding becomes available.

Tracking: T - Af, D.

- 3 - 2 **Comment:** "The EIS should also address steps to be taken to prevent other resource damage during the road construction activities."

Analysis: Measures to prevent resource damage from road construction will be included in this project. Needs unique to this project will be addressed, if any, and standard resource protection measures will be used.

Tracking: T - Af.

- 3 - 3 **Comment:** "... I did not see mention of attention to activities (if any), planned to monitor effects of the project on the various other forest resources. ... water quality ... wildlife species of concern ... I therefore urge you to address plans for monitoring in the EIS."

Analysis: Monitoring will be included as required and deemed appropriate.

Tracking: M - Af.

- 3 - 4 **Comment:** "Will designated snag trees be marked and efforts made to be sure they are protected?"

Analysis: Designated wildlife snag trees will be identified by marking and/or Timber Sale Contract specifications. Marking preference will be for those snags located away from roads or otherwise protected by natural features such as topography. This should deter their removal from the site by firewood cutters. Snags may also be retained through specifications that retain uncut areas of trees. Further efforts to protect the snags during harvest operations will occur through implementation of the Timber Sale Contract supervised by a Forest Service Sale Administrator.

Tracking: W - Af.

COMMENTER: WESTERN ANCIENT FOREST CAMPAIGN

- 4 - 1 **Comment:** Request to be added to project mailing list. No project-specific comments.

COMMENTER: SIERRA PACIFIC INDUSTRIES

- 5 - 1 **Comment:** "We can't afford to make the same mistakes [nonmanagement] on the balance of our landbase with regards to necessary fuel treatment to help minimize the risk of catastrophic wildfires that threaten all areas."

Analysis: One purpose and need for this project is to reduce the potential for large and intense wildfire across forested areas. The proposed action has been developed in response to this need. Other alternatives considered may address this need in various ways. Fuel loading and fire risk will be analyzed and disclosed.

Tracking: F - In #6, D.

- 5 - 2 **Comment:** "To look at this process [of fuel accumulation and wildfire] as some sort of natural cleansing through death and inevitable stand replacing fire only puts the entire ecosystem at risk."

Analysis: See response to Comment 5-1.

Tracking: F - In #6, D.

- 5 - 3 **Comment:** "The industry infrastructure exists to be profitable in business and as a partner in resource management within these forested communities."

Analysis: One purpose and need for the project is to recover some of the economic value of the dead trees. Analysis and disclosure for this project will include economic considerations.

Tracking: E - In #13, D.

COMMENTER: INSTITUTE FOR POLICY RESEARCH, NORTHWESTERN UNIVERSITY

- 6 - 1 **Comment:** Request to be added to project mailing list. No project-specific comments.

COMMENTER: SANPETE COUNTY COMMISSION

- 7 - 1 **Comment:** "... feels that it is extremely important to not only clear out this dead and infested timber as soon as possible ... but delays should be avoided."

Analysis: The proposed action includes salvage harvest of dead and dying timber from almost 6,600 acres. Completion of this project is a Forest priority. Work and staffing adjustments have been made to expedite completion. If harvest is approved, it is expected to take six years to complete the logging.

Tracking: V - Af.

- 7 - 2 **Comment:** "... important ... to replant seedlings and rehabilitate the harvested areas."

Analysis: One purpose and need for this project is to facilitate rapid reestablishment of Engelmann spruce through replanting in the Timber Management Emphasis Units. Engelmann spruce will be planted in harvested areas where natural regeneration would be inadequate, this includes both Timber Management Emphasis and Range Units. Where aspen occurs within the harvest areas, measures would favor aspen sprouting; spruce seedlings would not be planted within the fringe area around existing aspen clones; the width of the fringe area should not exceed the height of the dominant aspen trees in the clone or 2/3 the height of the surrounding conifer trees, whichever is greater. If aspen sprouting does not naturally occur where expected after harvest, mechanical preparation or prescribed fire may be used as part of post-harvest treatment of slash to further stimulate sprouting.

Tracking: V - Af.

7 - 3 **Comment:** "We agree that additional roads will be needed for the harvest and support the closure and re-habilitation of the new roads that will be constructed."

Analysis: See response to Comment 3-1.

Tracking: T - Af, D.

COMMENTS: GUNNISON IRRIGATION COMPANY

8 - 1 **Comment:** "We believe that it would be a serious mistake not to harvest and make use of the vast amount of this dead timber."

Analysis: See response to Comment 5-3.

Tracking: E - In #13, D.

COMMENTS: STATE OF UTAH, DEPT. OF NATURAL RESOURCES, DIV. OF WILDLIFE

9 - 1 **Comment:** "We are still concerned with the proposed regeneration of conifers through hand planting. During the field tours, the Forest Service mentioned that the forest had reached this point of beetle out breaks as a result of human intervention promoting dense stands of conifers from fire suppression and grazing. If the problem is caused by too high a density of conifers on the forest, do we want to perpetuate this problem by rapidly reestablishing conifers?"

Analysis: See Response to Comment 7-2. The proposed rapid reestablishment of spruce does not indicate that future stands would be overstocked. If stands later become overstocked, they can be addressed at that time independent of this project (i.e. by thinning).

Tracking: V - Af, D.

9 - 2 **Comment:** "We are uncomfortable with the idea that the area was historically an Engelmann spruce-Subalpine fir plant association to the same degree that is found there now. We are in agreement with you that human intervention has dramatically altered the vegetative makeup on the forest. The area's historic, pregrazing and prefire control, vegetative make up needs to be definitively researched and presented in the EIS."

Analysis: More historic information would be desirable. This project will try to incorporate historic information where feasible. The disclosed potential effects of this project will include consideration of past actions and conditions. Also, see response to comment 9-5.

Tracking: V - D.

9 - 3 **Comment:** "Areas that had an aspen component need to be promoted for aspen".

Analysis: See response to Comment 7-2.

Tracking: V - Af.

9 - 4 **Comment:** "... a dynamic aspen regeneration plan should be considered, one that includes hand planting of aspen to areas where original clones have died out ... in order to off set aspen losses to conifers in other areas."

Analysis: See response to Comment 7-2. Conversation with Wayne Sheppard of the Rocky Mountain Research Station indicated that planting aspen seedlings has had limited success. Only aspen planting in areas with sufficient moisture, such as riparian areas and wet ecosystems, have been successful. He indicated that either harvesting aspen or burning areas where aspen is present would promote aspen suckering response and have the best chance of success. The cultivation of aspen in of itself is outside the scope of this project and will not be further considered.

A number of projects have been accomplished in the past decade that contribute to the establishment or enhancement of aspen. Within the immediate area of this project, the Beaver Burn treated approximately 1,200 acres of aspen/mixed-conifer stands with prescribed fire in 1993. The area has successfully regenerated to aspen that number several thousand trees per acre and are currently about 10 feet tall.

Tracking: V - Af, Ad.

9 - 5 **Comment:** "... a dynamic aspen regeneration plan should be considered, one that includes ... promoting aspen in areas not thought to be historically aspen, in order to off set aspen losses to conifers in other areas. Given the yearly loss of aspen on the Manti, the Forest Service should consider aspen cultivation in areas that don't necessarily show definitive historic aspen presence."

Analysis: The area affected by the spruce bark beetle is in two distinct ecosystems. One is Engelmann spruce-Subalpine fir and the other is seral aspen associated with Engelmann spruce and subalpine fir. The Engelmann spruce-Subalpine fir ecosystem does not and did not contain aspen. Stands that did not contain aspen historically, will not regenerate to aspen. Many of these areas are typically above 10,000 feet and show no evidence of aspen.

Aspen can be, and has been, reasonably pursued in areas where aspen currently exists (see response to Comment 9-4).

Aspen growth within harvested stands will be encouraged (see response to comment 9-4).

The cultivation of aspen in of itself is outside the scope of this project and will not be further considered.

Tracking: V - Ad.

9 - 6 **Comment:** "Winter timber haulage has the potential to significantly impact wildlife on their winter ranges. Even small amounts of stress can have significant impacts on wintering wildlife. Trucks should not stop for picture taking, viewing, unnecessarily horn honking, or harassing wildlife by any other means. The option needs to be available that if winter timber trucking is determined by the Division of Wildlife to be negatively impacting wildlife then it will be stopped until April 15."

Analysis: Hauling from the project area west on Forest Development Road 50022 would not cross designated winter range on National Forest System land. Hauling from the project area east on Forest Development Road 50022 would go through approximately 6 miles of designated winter range on National Forest System lands.

The Forest Service does not have authority over hauling across non-National Forest System lands. The majority of wildlife winter range for deer and elk that could be affected by this project do not occur on National Forest System lands. The winter range is typically represented in areas of lower elevations which are also areas of heavy winter recreation use.

The normal operating season does not include winter operations. Winter operations would require subsequent approval from the Forest Service. The Timber Sale Contract will include provisions to address wildlife concerns. The contract will include prohibition of wildlife harassment while hauling logs on National Forest System lands during the winter. Upon request, consideration of a winter haul will be reviewed annually. Approval of winter haul will be based on current and predicted weather patterns and big game herd health and needs. The State of Utah Division of Wildlife Resources will be consulted in making an annual determination of winter haul use.

Tracking: W - In #7, Af, D.

9 - 7 **Comment:** "The area encompass critical calving and nursing areas on the Manti. In order to protect new born calves, timber harvesting and/or trucking should not be allowed in or through elk calving and nursery areas between May 15 and July 5."

Responses: Elk calving/nursing habitat within the project area will be identified. These areas are typically represented by areas of aspen and conifer/aspen mixed. The Timber Sale Contract will include

CT6.312# describing sale operation restrictions, will be made to protect elk habitat (i.e. calving and nursing areas). Areas identified as elk calving/nursing will not be operated in from May 15th to July 5th. Wildlife effects related to calving and nursing will be addressed in this project.

Tracking: W - In #7, Af, D.

- 9 - 8 **Comment:** *"If this [helicopter logging the area above Duck Fork Dam] changes to ground based harvest, then the dam will need to be upgraded. The upgrading would require; 1) Eighteen inches of fill over the dam with six inch compactions; 2) The emergency spillway needs to be concrete box culvert; 3) An SOP for dam safety needs to be developed and approved by Utah State Division of Water Rights; and, 4) Liability for dam impacts and failure due to truck traffic will be the responsibility of the Forest Service."*

Analysis: The Manti-La Sal National Forest has a non-exclusive special use permit to use this dam. A Forest Service engineer will determine measures to adequately protect it and make the appropriate contacts in completing this. In the event that damage from the logging operations occur that would prevent the dam from properly functioning, the Forest Service would be responsible for those damages and repair.

Tracking: T - Coordinate and analyze as needed, D.

- 9 - 9 **Comment:** *"We are disappointed that wildlife impacts were not mentioned as issues identified from the past NEPA analysis in the scoping document."*

Analysis: Although omitted in the Notice of Intent and scoping letter, wildlife was previously addressed and will be an issue addressed as part of this project.

Tracking: W - In #7, D.

- 9 - 10 **Comment:** *"The impacts to elk calving and nursery areas particularly need to be assessed..."*

Analysis: See response to Comment 9-7.

Tracking: W - In #7, D.

- 9 - 11 **Comment:** *"Increased mortality from wildlife displacement is also a main wildlife concern."*

Analysis: The potential for an increase in wildlife mortality due to displacement will be addressed as part of this project.

Tracking: W - In #7, D.

- 9 - 12 **Comment:** *"This invasion [of conifers] has been made possible in part through human manipulation such as fire suppression, and should be corrected through human manipulation where possible."*

Analysis: See the response to Comments 7-2, 9-4, and 9-5.

Tracking: V - Af, Ad.

- 9 - 13 **Comment:** *"We request that regenerating of conifers not be accelerated through hand plantings. ... thousands of aspen habitat are lost to conifers per year..."*

Analysis: See the response to Comments 7-2, 9-4, and 9-5.

Tracking: V - Af, Ad.

- 9 - 14 **Comment:** *"... we request that aspen stands be developed through plantings and selective clear cuttings..."*

Analysis: See the response to Comments 7-2, 9-4, and 9-5.

Tracking: V - Af, Ad.

- 9 - 15 **Comment:** *"Studies have shown that aspen stand development may require the removal of some mature aspen over 8-12 DBH along with conifers. This removal is necessary to stimulate aspen suckering..."*

Analysis: See the response to Comments 7-2, 9-4, and 9-5. Aspen regeneration will be addressed in the effects analysis of this project.

Tracking: V - Af, Ad, D.

- 9 - 16 **Comment:** *"We would greatly appreciate the opportunity to be part of the ID Team to determine appropriate fish passage structures."*

Analysis: To participate in the field review of fish passage structures, the State of Utah does not need to be part of the Interdisciplinary Team. However, the State of Utah will be invited to such field reviews.

Tracking: H - Af.

- 9 - 17 **Comment:** *"We agree with the proposed work period of July 1 through October 1. The area is critical elk and deer calving/fawning nursery habitat, and this time frame will have the least impact on: wildlife and hunting seasons. We request that adherence to this time frame be required in any permit issued as outlined in the EA."*

Analysis: The normal operating is July 1 through October 1. The purchaser would need written authorization to operate outside of the normal operating season. The timber sale contract will include a design feature common to all alternatives by where no hauling is permitted on weekends, and holidays. In addition all harvest activities are prohibited during the first nine days and the day before opening day of the general rifle elk hunt; harvest activities may occur during the last four days of the general rifle elk hunt; all harvest activities are prohibited during the first two days of the general rifle deer hunt and no hauling the day prior to the season opener. Potential effects to big game will be addressed in this project.

Tracking: W - In #7, Af, D.

- 9 - 18 **Comment:** *"In areas where raptors are found the time frame should be followed as outlined in the forest plan."*

Analysis: Appropriate buffers will be included as part of this project.

Tracking: W - Af

- 9 - 19 **Comment:** *"This project will displace elk and deer from the area and concentrate their impact on surrounding habitats. Displaced elk have a higher mortality rate, especially during the hunting season, than elk that remain on their home range(s)."*

Analysis: Potential displacement effects to deer and elk will be analyzed and disclosed as part of this project.

Tracking: W - In #7, D.

- 9 - 20 **Comment:** *"... all new roads and previously impassable roads should be closed to the public throughout the year to reduce wildlife displacement and vulnerability. ... newly created or previously impassable roads need to be closed and reclaimed at the end of the timber harvest."*

Analysis: See response to Comment 3-1.

Tracking: T - In #8, Af, D.

- 9 - 21 **Comment:** *"The soil type in the area is compactible and may require heavy equipment to rip tire ruts and ensure proper reclamation [of roads to be rehabilitated]."*

Analysis: Appropriate measures will be taken to ensure successful reclamation of roads to be rehabilitated.

Tracking: T - Af.

- 9 - 22 **Comment:** "Aspen stands should be withheld [from grazing] until they reach a minimum average height of eight feet."
Analysis: Areas of aspen within harvest units will be afforded the same protection as the remainder of the unit. Harvest units would have livestock excluded from them as necessary to ensure regeneration success. Protection needs will be identified through post-treatment monitoring of reforestation, which includes artificial and natural regeneration.
Tracking: V - Af.
- 9 - 23 **Comment:** "There is no mention of *Salix arizonica* (Arizona willow) . . . a Conservation Agreement and Strategy for *Salix arizonica* was developed in April 1995. . . . We understood that an immediate action resulting from the Conservation Agreement and Strategy was the addition of the willow to the US Forest Service Region 4's Sensitive Species list. . . . we hope that an analysis of the potential effects of this project to this plant can be added. . ."
Analysis: A discussion of the habitat requirements for and potential effects to Arizona Willow will be included in this project.
Tracking: V - D.
- 9 - 24 **Comment:** Requested clarification of the acreage of Federally listed plant species.
Analysis: The analysis for this project will address listed plant species.
Tracking: W - D.
- 9 - 25 **Comment:** "If forage areas used by deer and elk are at maximum potential they should have no point further than 200 yards from cover. Forage use beyond 200 yards from cover, becomes insignificant (U.S. Department of Agriculture Handbook No. 553). Security cover is cover that hides 90 percent of a standing adult elk from human view at a distance equal to or less than 200 feet. While thermal cover's importance differs according to the weather's severity, it is defined as a stand of coniferous trees more than 40 feet high with a 70 percent canopy closure. Since this area is not a winter range, we believe aspen can replace conifers for spring, summer and fall thermal cover."
Analysis: This project will analyze and disclose the effects upon elk including forage habitat, cover habitat, and habitat effectiveness.
Tracking: W - In #7, D.
- 9 - 26 **Comment:** "A fifty percent thinning of trees will severely limit the value of the remaining trees for security and thermal cover. We recognize salvage harvest limits the Forest Services' ability to leave trees on the ground. In areas that require clear cuttings and thinnings greater than what is needed by elk and deer, we request aspen be promoted in the area. Aspen should benefit wildlife by reestablishing security and thermal cover faster than conifers."
Analysis: See response to Comment 7-2 regarding post-harvest treatment. This project will analyze and disclose potential effects to deer and elk, including security and thermal cover.
Tracking: W - In #7, D.
- 9 - 27 **Comment:** "If possible, forage areas should comprise 60 percent of an area, with cover making up the remaining 40 percent."
Analysis: See response to Comment 9-25.
Tracking: W - In #7, D.

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- 9 - 28 **Comment:** "We recognize that the proposed mosaic pattern of cutting offers many benefits to wildlife in the area. We request, where possible, impacts of reduced security and thermal cover be avoided."
Analysis: This project will analyze and disclose potential effects to security and thermal cover. Measures would be taken in areas identified as having specific wildlife needs.
Tracking: W - In #7, Af, D.
- 9 - 29 **Comment:** "The Forest Service should follow their guidelines to protect three-toed woodpeckers, flying squirrels and other sensitive species."
Analysis: Requirements needed to protect three-toed woodpeckers, flying squirrels and other sensitive species would be included in this project. Additionally, potential effects to such species will be considered.
Tracking: W - In #7, Af, D, Biological Evaluation.

COMMENTER: CENTRAL UTAH WILDLIFE ASSOCIATION

- 10 - 1 **Comment:** ". . . it is important to us that all roads created for this purpose be recovered and restored to current standards."
Analysis: See response to Comments 3-1 and 9-21.
Tracking: T - In #8, Af, D.
- 10 - 2 **Comment:** "We are concerned with the environmental impact from improvement to the road system in this area."
Analysis: See response to Comment 3-1. Potential effects related to roads will be analyzed and disclosed for this project - including, but not limited to, effects to RARE II inventoried roadless areas and undeveloped character of the area.
Tracking: R, U - Is #1, In #11, Ac, D.
- 10 - 3 **Comment:** "We also feel that it would be easier to recover all trees from the Millfork/Blackfork drainage's rather than create access from the top."
Analysis: A yarding and transportation analysis was completed. Road and haul costs through the Millfork/Blackfork drainage were less, yarding costs were considerably higher. Based upon this analysis, recovery of all the trees through Millfork/Blackfork drainage was dropped from further consideration as not economically feasible.
Tracking: T - Ad.

COMMENTER: MAYFIELD TOWN BOARD

- 11 - 1 **Comment:** General support of the project.

COMMENTER: MARK ANDERSON, JEFF ANDERSON

- 12 - 1 **Comment:** ". . . it is important to us that all roads created or improved for this purpose be recovered and restored to current standards."
Analysis: See response to Comment 3-1.
Tracking: T - In #8, Af, D.

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- 12 - 2 **Comment:** "We are concerned with the environmental impact from improvement to the road system in this area."
Analysis: See response to Comments 3-1 and 10-2.
Tracking: R, U - Is #1, In #11, D.
- 12 - 3 **Comment:** "If the road across Baseball Flats south to White Mountain is improved, we feel the impact will not be from logging activities, but will come from the easy accessibility creating high impact activities."
Analysis: See response to Comment 3-1.
Tracking: R, U - Is #1, In #11, D.
- 12 - 4 **Comment:** "We also felt that it would be easier to recover all trees from the Millfork/Blackfork drainage's rather than create access from the top."
Analysis: See response to Comment 10-3.
Tracking: T - Ad.

COMMENTER: WAYNE SORENSON

- 13 - 1 **Comment:** "I feel more environmental damage will be done in one particular area because of the improved road, which brings a lot more people. Everyone knows that more people and little supervision can wreck an area environmentally. The area and the road I am referring to is the White Mountain area and the Baseball Flat road leading to this area ..."
Analysis: See response to Comments 3-1 and 10-2.
Tracking: R, U - Is #1, In #11, D.
- 13 - 2 **Comment:** "My concern is that this area [White Mountain and the Baseball Flat] will become an area like those around Twelve Mile Campground and the area around the old Ranger Station up Twelve Mile canyon. Both of these areas in my opinion have been environmentally damaged in the last 14 years because of the influx of people ..."
Analysis: See response to Comments 3-1 and 10-2.
Tracking: R, U - Is #1, In #11, D.
- 13 - 3 **Comment:** "My concern is that the remote White Mountain area, which has not been affected by the self-contained trailer, will be impacted environmentally because of the improved road making access for the self-contained trailer ... with their ATV's."
Analysis: See response to Comments 3-1 and 10-2.
Tracking: R, U - Is #15, In #11, D.
- 13 - 4 **Comment:** "... preserve the beauty of the remote White Mountain area. I see two options: 1) Only log from underneath the White Mountain using the Muddy Road as your access route. 2) Put the Baseball Flat road back to somewhat of its original form. For example, make little mounds on this road (mounds that can stop self-contained trailers from using the road) after the logging is done to create high clearance ..."
Analysis: See response to Comments 3-1 and 10-2.
Tracking: R, U - Is #15, In #11, Ad, D.

COMMENTER: LOUISIANA-PACIFIC CORPORATION

- 14 - 1 **Comment:** "It is sad to see the purpose and need of the South Manti project change from some proactive work ... to trying to pick up the pieces of what's left [from bark beetle activity]."
Analysis: The current project is limited to the opportunities and resources that exist at this time.
Tracking: O.
- 14 - 2 **Comment:** "... should address the loss in resources and values due to appeals and other obstructions which delayed this process. ..."
Analysis: While the cited actions, prevented previous implementation of similar activities in this project area, they are not a direct cost of this project. Such previous costs are attributable to that planning effort. The current project is limited to the opportunities and resources that exist at this time.
Tracking: O.
- 14 - 3 **Comment:** "... concern with ... maintaining the economic feasibility of potential harvest. The inclusion of a large amount of helicopter volume with the tractor portion of the salvage area initially appears to make the project infeasible at the present time."
Analysis: The logging system feasibility will be considered in the selection of logging systems. Responsive to other concerns, different alternatives are likely to have different degrees of logging systems. Additionally, if harvest is approved from this project and it could be sold with other approved sales which would thereby improve the overall economic feasibility of logging operations that may occur. It is possible that not all the areas proposed for treatment and ultimately approved will actually be harvested. Their inclusion in the project is strongly driven by resource needs. The amount of timber actually sold will depend upon market conditions and feasibility over time.
Tracking: E - In #13, D.
- 14 - 4 **Comment:** "... large sale offerings at this time [1996] could contain up to 25-30% helicopter volume and remain feasible ..."
Analysis: See the response to Comment 14-3. The information provided on economics will be considered in the analysis of this project.
Tracking: E - D.
- 14 - 5 **Comment:** "... impacts [from no action] ... can be lessened over the short and long term via economically and environmentally sound timber harvest."
Analysis: Analysis of potential effects from both action alternatives and no action will be part of this project.
Tracking: V - In #5, D.
- 14 - 6 **Comment:** "I don't believe the 'no action' alternative could be considered a responsible action ..."
Analysis: See response to Comment 14-5.
Tracking: V - D.
- 14 - 7 **Comment:** "The effects of harvest on riparian could be misinterpreted ... It may be more appropriate to list instead acreages impacted by roads at creek crossings ..."
Analysis: The effects of harvest on water and water-related resources will be analyzed and disclosed as part of this project, including roads crossing through riparian zone, floodplain, or wetlands.
Tracking: H - In #5, D.

- 14 - 8 **Comment:** "If spread or introduction of noxious weeds through logging operations is a concern, pressure washing of off-road equipment prior to its entering the sale area has been used effectively in other areas . . ."
- Analysis:** Provisions to minimize the risk of noxious weed spread will be included.
- Tracking:** V - Af.
- 14 - 9 **Comment:** "Would it be appropriate to allow some seasonal use [of newly constructed roads] during noncritical periods of wildlife use?"
- Analysis:** See response to Comment 3-1. Effects to wildlife will be considered as part of this project.
- Tracking:** W - In #7.

COMMENTS: SOUTHERN UTAH WILDERNESS ALLIANCE

- 15 - 1 **Comment:** "... no new roads should be constructed or reconstructed."
- Analysis:** See response to Comment 3-1.
- Tracking:** T - Ac.
- 15 - 2 **Comment:** "Any roads that are constructed, however, should be closed and obliterated immediately following treatment."
- Analysis:** See response to Comment 3-1.
- Tracking:** T - Af.
- 15 - 3 **Comment:** "... should inventory the entire plan area for consideration of roadless areas . . ."
- Analysis:** Designation and consideration for designation of roadless areas is beyond the scope of this project and will not be further addressed. Previously identified inventoried roadless areas, RARE II and Forest Plan, within and adjacent to the project area will be discussed and analyzed. Potential effects on the overall undeveloped character of the project area landscape will also be discussed and analyzed.
- Tracking:** R - Ad.
- 15 - 4 **Comment:** "... public should be assured that any action taken will not adversely affect the area's roadless qualities."
- Analysis:** See response to Comment 10-2 and 15-3. The subsequent decision will consider the potential effects of each alternative and incorporate agency direction in place at that time.
- Tracking:** R, U - Is #15, In #11, D.
- 15 - 5 **Comment:** "... consider other road closures in the area, reducing overall road density. Certainly, all spur and redundant roads should be closed."
- Analysis:** See response to Comment 3-1.
- Tracking:** T - Af.

- 15 - 6 **Comment:** "Access to roadless areas should not be improved, and these areas should not be advertised to visitors, thereby preventing damage to the roadless characteristics."
- Analysis:** See response to Comments 3-1, 10-2, and 15-3. Additionally, the public will not be encouraged to use improved access into roadless areas and they will not be permitted on newly constructed project roads unless authorized to do so.
- Tracking:** R, U - Is #15, In #11, Af, Ac, D.
- 15 - 7 **Comment:** "SUWA challenges the wisdom of mechanical or chemical treatment of any type in response to beetle infestation, and requests that the agencies consider other alternatives including prescriptive fire."
- Analysis:** The effects analysis will address the merits of the proposed treatment. An alternative that solely uses prescribed burning to reduce wildfire potential and respond to the bark beetle would not wholly meet the purpose and need for this project. Additionally, prescribed burning in areas having extensive tree mortality is risky and unpredictable. The primary tree species (aspen, spruce, and subalpine fir) within the project area are not tolerant nor resistant to the occurrence of fire. The consequences of prescribed burning or allowing natural fire to burn under these conditions could result in unacceptable damage to the resources of the area, including the loss of remaining available trees and cover in the affected areas. Correspondingly, such an alternative is dropped from further consideration.
- Tracking:** F - Ad, D.
- 15 - 8 **Comment:** "... coordinate with the Division of Wildlife Resources to protect wildlife and wildlife habitat, including aquatic species, especially for any existing threatened and endangered species."
- Analysis:** The Forest has contacted all appropriate management and regulatory agencies - including the State's Division of Wildlife.
- Tracking:** W - Agency Coordination.
- 15 - 9 **Comment:** "The impacts to the watershed, including soil erosion and productivity, water quality and quantity, and riparian and wetland health, must be thoroughly analyzed."
- Analysis:** Potential impacts to water and water-related resources will be addressed and disclosed.
- Tracking:** H - In #4, D.
- 15 - 10 **Comment:** "A cultural resource inventory must be performed, and any impacts should be adequately mitigated."
- Analysis:** Cultural Resource surveys and consultation with the State Historic Preservation Office will occur. Potential impacts to cultural resources will be analyzed and disclosed.
- Tracking:** C - In #12, D.
- 15 - 11 **Comment:** "... the visual resources of the area should be protected."
- Analysis:** This comment seems more appropriate to a healthy, green forest condition. The visual character of the area has already been affected by a spruce beetle epidemic which has killed the majority of spruce trees in the area. Measures would be taken to reduce visual impacts (e.g. irregularly-shaped harvest boundaries, graduated harvest along harvest boundaries, leaving areas, etc.). Impacts to visual resources will be analyzed and disclosed.
- Tracking:** S - In #10, Af, D.
- 15 - 12 **Comment:** "The intent of this project should be to improve forest, wildlife, and watershed health, and not to create additional range for livestock grazing or to provide board feet for the extractive timber industry. Thus the alternatives should be based on this premise, and consider the above concern."

Analysis: The scope of the project is largely affected by existing resource conditions and opportunities. The project's purpose and need has already been set by the Forest Supervisor based on existing resource conditions. The purpose and need is more than recovery of a marketable product, it includes reducing the potential for large and intense wildfires across forested areas (with associated environmental effects) and facilitating rapid reestablishment of Engelmann spruce through replanting of spruce. Alternatives must meet the project's purpose and need while addressing an unresolved conflict with the proposed action. These two components of the purpose and need have associated implications to biodiversity and ecosystem stability. Alternatives will address and affect various resources in different ways.

Tracking: O.

COMMENTS: SOUTHWEST CENTER FOR BIOLOGICAL DIVERSITY

- 16 - 1 **Comment:** "We request the inclusion of an alternative which would achieve the goals of this project (reduce wildfire potential, respond to bark beetle problem) without resorting to a commercial timber sale. Please understand this alternative would not be a 'no action' alternative but would simply examine alternative methods of management. Possible examples include removing the analysis area from the suitable timber base or utilizing prescribed burning."

Analysis: Reclassification of the suitable timberland in the project area to unsuitable is beyond the scope of this project. Additionally, it would not accomplish the project's purpose and need differently than that of the proposed action. Salvage harvest can occur on unsuitable timberlands to protect or provide multiple-use values (36 CFR 219.27(c)(1)). The requested reclassification is dropped from further consideration.

Regarding prescribed fire, see response to Comment 15-7.

Tracking: V - Ad.

- 16 - 2 **Comment:** "... request the inclusion of an alternative which would, in accordance with the National Forest Management Act (NFMA), utilize uneven aged management practices."

Analysis: The implementing regulations of NFMA are found at 36 CFR 219. While NFMA requires a justification for the use of even-age management, there is no requirement in NFMA to use uneven-aged management practices. However, the nature of the existing beetle-caused spruce mortality lends itself to well to uneven-aged management. Correspondingly, the timber harvest proposed in this project would be accomplished through uneven-aged management.

Tracking: V - Ad.

- 16 - 3 **Comment:** "... draft and final EIS's must include full and honest consideration of the effects of this action on threatened, endangered, and management indicator species."

Analysis: Effects to the Threatened, Endangered and Management Indicator Species will be addressed and disclosed for this project. Threatened and Endangered species are categories of species listed under the Endangered Species Act. The Forest will complete a Biological Assessment for all such listed species in the project area. If we determine that the proposed action or preferred action may jeopardize the continued existence of a listed species or result in the adverse modification of critical habitat, we will confer with the U.S. Fish and Wildlife Service.

Tracking: W - In #7, D, Biological Assessment, Consultation with U.S. FWS if necessary.

- 16 - 4 **Comment:** "... address the cyclical ecology of the spruce bark beetle. Although the Manti-La Sal maintains that the epidemic is becoming steadily and progressively worse, scientific literature suggests that the ecology of these infestations is more cyclical than linear, and that a particularly cold winter may in fact halt the epidemic. Does the Forest Service's projections with respect to "dying" trees take this possibility into account?"

Analysis: The cyclical ecology of spruce beetle is not relevant to the current project, which is strictly a salvage of dead and dying timber. Although it will not be further discussed in the analysis for this project, a brief

synopsis is provided here. The cumulative effects of a continuing outbreak typically increase over time until insect populations collapse. Cold temperature can affect developing stages of the insect: lethal temperatures within the tree phloem need to reach -15° F to cause adult beetle mortality or -30° F to kill all life stages of this insect. Various percentages of adult beetles migrate to the base of the tree to overwinter, these overwintering sites provide thermal protection. If snowfall amounts were low and temperatures reached -15 to -30° F, significant beetle mortality would occur. These temperatures have not been reached on the Manti-La Sal when snowfall amounts were low or absent. Populations will decrease in sites where most of the suitable host (spruce larger than 10 inches in diameter) has died. As the insects attack smaller diameter hosts, broods are reduced or they die as a result of the thin phloem layer. The thin layer of phloem generally found on spruce less than 8 inches in diameter is unable to sustain a single generation of spruce beetle - particularly when their extent and intensity are considered.

Tracking: V - O.

- 16 - 5 **Comment:** "It is the Forest Service's responsibility to demonstrate how this sale will benefit forest health. Scientific literature shows that fire, spruce beetle outbreaks and windthrow all play an important role in shaping the development of spruce - Subalpine fir forests."

Analysis: Forest health will be addressed for this project. Although fire, spruce beetle, and windthrow play role in spruce-fir ecosystems, there are environmental consequences (both biophysical and social) of these natural events.

Tracking: V - In #5, D.

- 16 - 6 **Comment:** "Is it the Manti-La Sal's contention that this sale would eliminate the spruce bark beetle epidemic?"

Analysis: The Forest is not contending that the proposed action would eliminate the spruce beetle epidemic. The purpose and need for this project is to reduce the potential for large and intense wildfire, facilitate rapid reestablishment of spruce through replanting in the Timber Management Emphasis Units, and to recover some of the economic value of the dead and dying trees. Because of the magnitude of the current beetle epidemic, no treatments within the project area are expected to eliminate it.

Tracking: V - O.

- 16 - 7 **Comment:** "Is there a chance that the cutting and hauling of infested trees could infest other healthy areas of the forest?"

Analysis: Removal of infested logs will result in little to no emergence of adult beetles. Mountain pine beetle research indicates very few adult beetles emerge during transport of infested logs (W.C. Schaupp et al., Research Note RM-522, "Mountain Pine Beetle Emergence from Infested Logs during Hauling"). Although the study was conducted with Mountain pine beetle in Ponderosa pine, Spruce beetle is a closely related species in the same genus. Field surveys by Forest Health Protection staff indicate that there is no evidence of spruce beetle attacked host trees in advance of the generally infested area or in the communities of Mayfield or Gunnison, Utah - despite previous transport of infested logs. This topic will not be carried forward into the analysis for this project.

Tracking: V - O.

- 16 - 8 **Comment:** "How does the Forest Service reconcile offering this sale to reduce the risk of wildfire when salvage logging has been shown in several studies to actually increase the risk of fire?"

Analysis: The presence of readily burnable material affects the potential for a wildfire to start and spread. Large amounts of dead timber represent a readily burnable material. Removal of dead trees has been shown to reduce the associated fire risk and potential fire severity should a fire start. Analysis and disclosure for this project will include consideration of fuel loading and fire risk.

Tracking: F - In #6, D.

16 - 9 **Comment:** *"The draft and final EIS's should contain an exhaustive analysis of the literature concerning the structure and dynamics of spruce - Subalpine fir forests as well as the efficacy of salvage logging in meeting the purported goals of this sale."*

Analysis: An Interdisciplinary Team of resource specialists has been established appropriate for the scope of analysis required for this project. The extent of reference material used in the resulting analysis is at the discretion of the resource specialist, usually dependant upon the nature of the action, resulting issues, and anticipated effects. There is no requirement for an exhaustive analysis of literature. Referenced material will be indicated in the EIS.

Tracking: Appendix.

16 - 10 **Comment:** *"The project as proposed is still a gross violation of the Manti-La Sal Forest Plan, thus violating NFMA, as it proposes to offer a quantity of timber exponentially in excess of the Forest Plan ASQ. The Manti-La Sal cannot move forward with analysis until it amends the Forest Plan."*

Analysis: The implementing regulations of NFMA for developing, adopting, and revising Forest Plans are found at 36 CFR 219. ASQ is defined as the quantity of timber that may be sold from the suitable timberland for a specific time period (36 CFR 219.3). The sale schedule in the Forest Plan provides the ASQ (36 CFR 219.27(c)(2)). However, the regulations at 36 CFR 219.27(c)(2) go on to clarify that, "Nothing in this paragraph prohibits salvage or sanitation harvesting of timber stands which are substantially damaged by fire, windthrow, or other catastrophe, or which are in imminent danger of insect and disease attack and where such harvests are consistent with silvicultural and environmental standards. Such timber may either substitute for timber that would otherwise be sold under the plan or, if not feasible, be sold over and above the planned volume." The proposed action deals with salvage, not the harvest of live timber. Consequently, the proposed harvest in excess of the planned ASQ neither violates NFMA or the Forest Plan.

The Record of Decision for the Forest Plan, signed November 5, 1986, sets the ASQ at 38 MMBF for the first decade of plan implementation due to "poor markets and limited demand", while the long-term sustained yield is estimated to be 262 MMBF per decade. As noted above, the salvage harvest does not necessarily accrue to the ASQ; but even if it did, the total harvested volume is still well within the long-term sustained yield capacity of the Forest, and is within the range of harvest volumes considered and analyzed in the Forest Plan EIS.

Tracking: O.

16 - 11 **Comment:** *"Why is the Manti-La Sal insisting on moving forward with this sale in the face of such widespread and intense public opposition? This issue needs to be addressed in the draft and final EIS's."*

Analysis: Twenty letters were received in response to soliciting comments on the proposed action. This scale of response does not indicate widespread and intense public opposition to the project. Several letters were supportive of the project or contained items of clarification, rather than opposition. Comments of opposition will be addressed according to the topic of the comment. If the topic warrants recognition as an issue, it will be carried through the analysis as such. The fact that public comment or opposition was expressed is not justification for it to be an issue in of itself. Public attitudes, however, will be reflected through the issues resulting from the received comments. There is no prohibition from proposing or selecting an action for implementation that has public opposition.

Tracking: O.

16 - 12 **Comment:** *"We also question the propriety of this sale in light of the proposed 18 month moratorium on road building in the National Forest roadless areas. This moratorium is being promulgated in recognition of the 'significant ecological values of roadless areas,' 63 Fed. Reg. 4351 (1998). In light of this purpose the proposed helicopter and ground based logging within three RARE II roadless areas violates the spirit if not the letter of the moratorium."*

Analysis: Project planning is initiated with the development of a proposed action and subsequent solicitation of comment. This stage of project planning does not make a decision for implementation. As such, it does not violate the letter or spirit of the cited moratorium. The proposed action is only one of the alternatives that will be analyzed and considered for implementation. An alternative that does not enter inventoried roadless areas will be one of the alternatives analyzed and considered for implementation. The analysis of alternatives will include potential effects to lands identified in the RARE II inventory as roadless. The subsequent decision will consider the potential effects of each alternative and incorporate agency direction in place at that time.

Tracking: R, U - Is #15, In #11, Ac, D.

COMMENTS: SATTERWHITE LOG HOMES

17 - 1 **Comment:** *"Potential environmental damage due to no action demands that dead spruce be removed as soon as possible so that it may be replaced by a young, healthy forest."*

Analysis: The project is intended to reduce or eliminate excessive environmental damage. Both action alternatives and no action will be considered for this project.

Tracking: O.

17 - 2 **Comment:** *"The dead spruce still has an economic value and should be harvested while it has value, not wait until it is an environmental as well as economic liability."*

Analysis: One purpose and need for the project is to recover some of the economic values of the dead and dying trees.

Tracking: O.

17 - 3 **Comment:** *"Many jobs and much economic impact is at stake . . ."*

Analysis: See response to Comment 5-3.

Tracking: E - In #13, D.

17 - 4 **Comment:** *"In light of the current debate over road construction and roadless areas, on the South Manti considerations could be made for longer skid distances, use of forwarders, and possible requirements for winter logging to lessen disturbance and soil compaction."*

Analysis: See response to Comments 2-1, 3-1, and 5-3. Forwarders were not considered in detail as part of this project because there are no such available equipment sources known in Utah and the cost of a new one would not be supported by the proposed treatment.

Tracking: Ad.

17 - 5 **Comment:** *"Helicopter yarding would be a last resort in that it would increase costs and therefore yield much less revenue to the government."*

Analysis: See response to Comments 2-1, 5-3, and 14-3.

Tracking: E - In #13.

17 - 6 **Comment:** "Both timber operations and environmental groups might applaud exclusion of areas too steep (over 50°) for conventional logging. This would create undisturbed pockets for wildlife, minimize catastrophic fire potentials, and yield higher revenues from timber sales."

Analysis: See response to Comment 2-1 and 14-3. The effects of harvest treatments upon wildlife, fuels, and economics will be disclosed as part of this project.

Tracking: W, F, E - D.

COMMENTS: U.S. FISH AND WILDLIFE SERVICE

18 - 1 **Comment:** "Prior to continued harvest of infested trees, we recommend an analysis of the expected effectiveness of salvage operations for beetle control in this area. In certain circumstances, spruce bark beetle outbreaks are exacerbated by thinning operations intended to control the outbreak."

Analysis: The proposed action is not intended to control beetles in the area. The purpose and need for this project is to reduce the potential for large and intense wildfire, facilitate rapid reestablishment of spruce through replanting in the Timber Management Emphasis Units, and to recover some of the economic value of the dead and dying trees. However, the Forest has been monitoring the past 2,450-acre harvest area and will apply those results to the proposed harvest areas. Thinning is not part of this proposal because most of the trees are already dead. Therefore, thinning is dropped from further consideration.

Tracking: V - O.

18 - 2 **Comment:** "The value of dead and dying trees to a wide array of wildlife is well documented as providing hunting perches, foraging sites, roosts, nest sites, and den sites for birds, mammals, and reptiles. Ideally, six to seven snags/acre should be retained."

Analysis: The value of dead and dying trees to wildlife is recognized and will be disclosed in the analysis for this project. While some dead and dying trees are proposed for harvest, others will remain across the landscape and some will remain within harvest units. 300 snags per 100 acres will be retained in harvested areas. Additionally, all trees with cavities in them will be retained and harvest slash will be retained on 10% of the harvested areas. In the project area as a whole, available snags will far exceed minimum requirements. This is due to riparian areas being protected and the substantial acreage with dead spruce that is not being considered for harvest treatments, in addition to snags being left within the proposed harvest units.

Tracking: W - In #7, Af, D.

18 - 3 **Comment:** "The EIS should clarify what is considered a 'dying' tree; i.e., at what level of infestation is a tree scheduled for removal. We would be concerned with removal of live trees considered to be at high risk of infestation"

Analysis: Dead trees are those spruce trees in which the flow of nutrients in the cambium/phloem layer, beneath the bark, has ceased. These trees may or may not look dead, depending upon how long they have been dead. Dying trees are those spruce trees with multiple spruce beetle attacks that encircle the tree bole. Dying trees are usually dead within a year of such infestation. Dead and dying trees are proposed for harvest. High risk trees and live, uninfested trees are not proposed for harvest.

Tracking: V - D, Glossary.

18 - 4 **Comment:** "Natural conditions such as harsh winters may rectify the spruce beetle problem without human intervention..."

Analysis: See response to Comment 16-4.

Tracking: V - In #5, D.

18 - 5 **Comment:** "... harvest of live trees may result in more harm to the array of wildlife species dependent on the spruce-fir ecosystem."

Analysis: Only dead and dying trees are planned for harvest. The effects to wildlife will be considered and disclosed for this project

Tracking: W - D.

18 - 6 **Comment:** "Road construction should avoid sensitive wildlife habitats, including wetlands and riparian areas."

Analysis: All activities will comply with wildlife- and water-related laws imposed for the protection of resources. Wetlands will be avoided wherever possible, where they cannot be avoided mitigative measures will be taken to protect the resources. If practical, there will be no road construction within riparian areas. Where roads must cross a riparian area, it will be as perpendicular to the riparian area as practical. In all cases, Best Management Practices will be used to minimize effects associated with water resources.

Tracking: W - Af, D.

18 - 7 **Comment:** "Given the extent of potential direct, indirect, and cumulative impacts of roadways to wildlife, we would recommend closure and reclamation of all new roads following harvest."

Analysis: See response to Comment 3-1.

Tracking: W - Af.

18 - 8 **Comment:** "... closure of existing roads should be assessed for areas considered important wildlife use areas."

Analysis: See response to Comment 3-1.

Tracking: W - Af.

18 - 9 **Comment:** "Literature review has established that mule deer are negatively affected by roadways for a distance 200m proximal to the road. Similarly, elk are negatively affected for a distance 800m from the road. Midsize and larger carnivores have been documented to avoid areas within 1 km and 3 km of highways in forested and open habitats, respectively. Disturbances can result in increased heart rates and displacement by wildlife encountered; either behavior is known to accelerate the consumption of energy reserves which may be essential in allowing that animal to survive winter conditions."

Analysis: The above information is acknowledged. Habitat requirements for and effects to management indicator species, threatened species, endangered species and sensitive species will be addressed for this project.

Tracking: W - In #7, D.

18 - 10 **Comment:** "We are increasingly concerned with cumulative impacts to wildlife associated with other land use activities, including timber harvests, oil/gas development, and road construction/improvement. We ask that an analysis take into account the long term effects to wildlife populations of increasing human use of high-value habitats."

Analysis: The cumulative impacts of past, present and reasonably foreseeable future actions will be presented and analyzed as part of this project.

Tracking: W - D.

18 - 11 **Comment:** "Enclosed are lists of threatened (T), endangered (E), and candidate (C) species that may occur in the area of influence of your proposed action."

Analysis: Listed species will be addressed as part of this project.

Tracking: W - D.

- 18 - 12 **Comment:** "While candidate species have no legal protection under the Endangered Species Act, we ask that you try to avoid them if they are found in the area."
- Analysis:** There currently are no Candidate species on the Forest. If such species are later identified, they will be afforded protection as part of this project.
- Tracking:** W - Af.
- 18 - 13 **Comment:** "You should review your proposed action and determine if the action would affect any listed species or their critical habitat. You should also determine if the action is likely to jeopardize the continued existence of proposed species or result in the destruction or an adverse modification of any critical habitat proposed for such species. If the determination is 'may affect' for listed species, you must request in writing formal consultation from the Assistant Field Supervisor, at the address given above. In addition, if you determine that the proposed action is likely to jeopardize the continued existence of proposed species or result in the destruction or adverse modification of proposed critical habitat, you must confer with this office. At that time, you should provide this office a copy of the biological assessment and any other relevant information that assisted you in reaching your conclusion. . . ."
- Analysis:** The effects to threatened, endangered, and candidate species and their habitats will be addressed. Consultation protocols will be followed.
- Tracking:** W - In #7, P, Biological Assessment, Consultation with U.S. FWS if necessary.
- 18 - 14 **Comment:** "... the Endangered Species Act, Migratory Bird Treaty Act, and Eagle Protection Act afford protection to raptors, their nests, and habitats"
- Analysis:** These laws and their association to raptors are recognized and will be followed.
- Tracking:** W - In #7, Af, D.
- 18 - 15 **Comment:** "Pre-harvest surveys should be accomplished to document nesting, roosting, and foraging habitats for raptors."
- Analysis:** Several surveys have been conducted. Additional surveys will occur prior to project implementation and appropriate buffers will be included as needed.
- Tracking:** W - Af.
- 18 - 16 **Comment:** "Seasonal and spatial buffers from human activity should be applied to known nest and roost sites."
- Analysis:** Appropriate buffers will be included as part of this project.
- Tracking:** W - Af.
- 18 - 17 **Comment:** "Habitat sufficient to maintain and improve raptor nesting and foraging habitats should be determined and allocated as part of the harvest prescription."
- Analysis:** See Response to Comment 18-6.
- Tracking:** W - Af.

COMMENTS: C. Jay Larson

- 19 - 1 **Comment:** "It appears to us that removing the old timber will allow a faster recovery of the whole forest area and it most certainly enhances the overall appearance and beauty of the forest."
- Analysis:** A desired future condition for the area is predominantly live, green forest. An effects analysis will address forest health.
- Tracking:** V - In #5, D.

- 19 - 2 **Comment:** "We also fear the increased possibilities of forest fires caused by standing dead timber."
- Analysis:** One purpose and need for the project is reduce the potential for large and intense wildfires across forested areas. Analysis of this project will address fuels and the risk of wildfire.
- Tracking:** F - In #6, D.
- 19 - 3 **Comment:** "We are not too much concerned about additional roads so long as the number is controlled within reason."
- Analysis:** See response to Comment 3-1.
- Tracking:** T - Ac.
- 19 - 4 **Comment:** "We have observed over the years that the forest has the ability to recover very rapidly so long as the excavation size is kept under control."
- Analysis:** The size, timing and extent of project activities will be managed to aid in the recovery and rehabilitation of the area.
- Tracking:** V - In #5.

COMMENTS: UTAH FARM BUREAU FEDERATION

- 20 - 1 **Comment:** "Local saw mills are in desperate need of timber and one locally in South Sanpete (Satterwhite) is positioned to utilize this needed resource."
- Analysis:** See response to Comment 2-1.
- Tracking:** E - In #13, D.
- 20 - 2 **Comment:** "The benefits of supplying timber to these mills is far reaching in the economy of surrounding counties and to the state. By-products from these mills, such as shavings, are a great cost savings to the turkey industry."
- Analysis:** See response to Comment 2-1.
- Tracking:** E - In #13, D.

LIST OF AGENCIES, ORGANIZATIONS, AND INDIVIDUALS RECEIVING THIS DOCUMENT

The following parties, at a minimum, have been sent a copy of this Draft Environmental Impact Statement.

AGENCIES

Utah State Office of Planning/Budget	USDA, Dixie National Forest
Utah State Department of Natural Resources	USDA, Uinta National Forest
Utah State Division of Water Rights	USDA, Fishlake National Forest
Utah State Division of Water Quality	USDA, Bureau of Reclamation, Upper Colorado
Utah State Division of Wildlife Resources	USDA, Forest Service, Intermountain Regional Office
US Environmental Protection Agency	USDI, Fish and Wildlife Service
USDA, Ashley National Forest	USDI, Office of Environmental Affairs
USDA, Wasatch-Cache National Forest	

ORGANIZATIONS AND LOCAL GOVERNMENTS

AFSEEE	Hansen Lumber Company	Satterwhite Log Homes
Back Country Horsemen of Utah	Hassig Incorporated	Schenck Brothers
Boise Cascade	Hatcher & Eiland, Inc.	Senator Orrin Hatch Office
Canyonlands Wildlife Federation	High Uintas Preservation Council	Sierra Club
Carbon County Commissioners	Hopi Tribe Cultural Preservation Office	Sierra Club - Ogden Group
Cascade Mountain Resources	Intermountain Forest Industry	Sierra Club - SW Region
Central Utah Wildlife Association	Jake Olsen Excavating	Sierra Club - Utah Chapter
City of Ferron	Joes Valley Marina	Sierra Club - Utah Valley Group
Columbia Helicopter Inc.	Kaibab Forest Products	Skyhaven Lodge
Coltonwood Creek Livestock Assoc.	Ken's Logging	Southern Utah Forest Products Assoc.
Cowart Construction	Lon Sawmill, Inc.	Southern Utah Wilderness Alliance
Cyprus Plateau Mining Co.	Louisiana-Pacific	Southwest Center for Biological Diversity
D & G Construction and Logging	Manti Woolgrowers Association	Spruce-Wood Products
Dan's Sawmill	Mayfield City Council	Stoltze Aspen Mills
Department of Environmental Quality	Mayfield Irrigation Company	The Nature Conservancy
Desert News	Meridian Oil, Inc.	The Wilderness Society
Dingman Lumber Company	Mountain Home Logging	Timber Products, Inc.
Doug Jones Sawmill	Navajo Nation	Todd Enterprises, Inc.
Draper's Sawmill Company	Nielsen & Senior	Trail Mountain Livestock Assoc.
East Carbon Wildlife Federation	Nielson Sawmill	Twelve-Mile Grazing Association
East Mountain Cattle Association	Northwest Lumber	Uintah Mountain Club
Elk Ridge Logging	Paiute Tribe	Utah Assoc. Municipal Water Systems
Emery Cattlemen's Association	Paiute Tribe of Utah	Utah Cattlemen's Association
Emery County Commissioners	Ponderosa Timber Company	Utah County Commissioners
Emery County Economic Development	Prestwich Lumber	Utah Environmental Congress
Emery County Public Lands Council	Recreation Lands Unlimited Inc.	Utah Forest Products
Emery Water Conservancy District	Rock Canyon Preservation Alliance	Utah Power and Light Company
Fairview Land and Livestock Assoc.	Rocky Mountain Cutting	Utah Wildlife Federation
Farm Bureau	Rocky Mountain Log Homes	Ute Indian Tribe
Ferron Cattlemen's Association	S.E.C. Inc.	Ute Mountain Ute Tribe
Fishlake Lumber Company	SE Utah Association of Local Govt.	Western Association of Land Users
Forest Guardians and FCC	SRS Timber	White Mesa Ute Council
G & F Logging Company	Salt Lake Tribune	Wild Utah Forest Campaign
Gerber Engineering	San Juan Commissioners	Yellowstone Log Homes
Great Salt Lake Audubon	San Juan Timber Products	
Gunnison City Council	Sanders Logging	
Gunnison Irrigation Company	Sanpete County Commissioners	

INDIVIDUALS

Ada J. and Perry Eliason	Honorable Orrin G. Hatch	Owen Severance
Adrian Gerritsen	Honorable Robert Bennett	Paul Frischknecht
Andy Ludon Jensen	Ira Hatch	Postelle R. Vaughan
Arthur Northrup	Jack Anderson	Randy and Wendy Cowley
Bill Ingalls	Jack Campbell	Ray Wareham
Blake Liddell	Jack J. Funk	Richard Fausel
Bruce J. Barton	James Gregerson	Robert M. Kennedy
C. Jay or Natalie Larson	Jerry and Frances Price	Robert Mossman
Charles W. Lund	Joel Frandsen	Roger M. Barton
Craig Axford	John Niebergall	Ross Boyack
Dave Naslund	Ken Christiansen	Rue P. Ware
Dean Behling	Kent Sleight	Russel Jensen
Dick Carter	Kevin Walker	Russell Cowley
Don Holyoak	Larry Winn	Thomas J. Messenger
Douglas Willden	Lee McElprang	Vera Nickas
Edward S. Syrjala	Lewis Black	Victor Satterfield
Erick Faatz	Lewis Freeman	Wayne Sorensen
Eugene Bartholomew	Mark Anderson	Wayne Staley
Grant and Esther Burbidge	Mark V. or Ruth Bunderson	Wesley and Barbara George
H. Riedel George	Maughn Guymon	William M. Miller
Hal C. Johnson	Max Jensen	
Honorable Chris Cannon	Mr. and Mrs. Biddinger	
Honorable Merrill Cook	Narlene Manson	

APPENDIX C

FOREST PLAN DIRECTION

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APPENDIX C - FOREST PLAN DIRECTION

This appendix of Forest Plan direction is intended to provide the reader with the minimum parameters of Forest Plan direction (also referred to as standards and guidelines) under which any alternative selected for implementation would normally have to follow, if applicable. However, if Forestwide direction differs from direction for the Management Unit direction, the Management Unit direction takes precedence.

Forestwide direction and Management Unit direction may be amended if it is specifically addressed for a project and subsequently approved. No amendment are currently identified for implementation of any action alternative.

The following listing of Forest Plan Direction is divided into two main sections: I. Forestwide Management Direction and II. Management Unit Direction.

I. FORESTWIDE MANAGEMENT DIRECTION

The following are excerpts of the Forestwide general direction from the Manti-La Sal National Forest's Forest Plan. This list reflects an itemization of all the Forestwide direction, as indicated by resource topic and numbering. Direction not pertinent to the nature of this project are identified as "Not Applicable" and are not itemized in this listing. To reduce the length of this appendix, additional explanations included in the Forest Plan are omitted here.

Cultural Resource Management

- 01 Protect, find an adaptive use for, and or interpret cultural and paleontologic resources on National Forest System lands which are listed on the National Register of Historical Places the National Register of Historical Landmarks, or may be determined to be eligible for the national register. (p. III-16)
- 02 Nominate or recommend cultural or paleontological sites to the National Register of Historic Places or National Natural Landmarks. (p. III-16)
- 03 Protect and foster public use and enjoyment of cultural and paleontological resources. (p. III-16)
- 04 Use a predictive model to determine areas of high and low potential for cultural resources. Design site-specific survey requirements in various areas on the basis of the predictive model, after appropriate review and approval. (p. III-16)

Visual Resource Management

- 01 Forest resource uses or activities should meet the adopted Visual Quality Objective (VQO) as displayed on the Planned VQO Map. (p. III-17)
- 02 Design and implement management activities to blend with the natural landscape. (p. III-17)
- 03 Rehabilitate existing projects and areas which do not meet the adopted Visual Quality Objectives specified for each management unit. (p. III-17)
- 04 Achieve landscape enhancement through addition, deletion or alteration of landscape elements. (p. III-17)

Management of Developed Recreation Sites

- 01 Manage sites identified for developed recreation under the Developed Recreation Site (DRS) Management Unit. (p. III-17)

Dispersed Recreation Management

- 01 Describe, as appropriate, high interest or unique geological, paleontological, biological, archeological, or historical features for public information and, as appropriate, develop interpretive information for these sites. (p. III-17)
- 02 Provide opportunities for roaded natural appearing, semiprimitive motorized, and semiprimitive nonmotorized recreation uses. (p. III-18)

- 03 Classify areas as to whether vehicular travel use is restricted. (p. III-18)
- 04 Restrict use and/or rehabilitate dispersed sites where unacceptable environmental damage is occurring. (p. III-18)
- 05 Limit camping near lakes and streams or in watersheds as necessary to protect riparian and aquatic ecosystems and to maintain the quality of the recreation experience. (p. III-18)
- 06 Preclude camping in undeveloped sites within one quarter mile of developed fee sites, where it is appropriate. (p. III-18)
- 07 Manage dispersed recreation activities and use of trails in dispersed areas to not exceed the established PAOT/acre or site or trail capacity. (p. III-18)

Recreation Management (Private and Public Sector)

Not Applicable. (p. III-19)

Wilderness Area Management

Not Applicable. (p. III-19)

Wildlife and Fish Resource Management

- 01 Provide habitat needs, as appropriate, for management indicator species. (p. III-19)
- 02 Manage habitat for recovery of endangered and threatened species. (p. III-21)
- 03 Implement activities to meet the Forest's share of approved recovery plans. (p. III-21)
- 04 Manage habitat of sensitive species to keep them from becoming threatened or endangered. (p. III-21)
- 05 Maintain and/or improve habitat and habitat diversity for minimum viable populations of existing vertebrate wildlife species. (p. III-22)
- 06 Provide for habitat needs of cavity nesting birds, raptors, and small animals. (p. III-22)
- 07 Manage down timber to provide habitat for wildlife. (p. III-22)
- 08 Manage waters capable of supporting self-sustaining fish populations to provide for populations. (p. III-22)

Wildlife Habitat Improvement and Maintenance

- 01 Maintain or improve habitat capability through direct treatment of vegetation, soil, and/or water. (p. III-23)
- 02 Manage non-commercial aspen stands in mixed age groups to provide a source of forage. (p. III-23)
- 03 Give wildlife funding priority to habitat improvement projects which are jointly or cooperatively funded with the states. (p. III-23)
- 04 Use both commercial and non-commercial silvicultural practices to accomplish wildlife habitat objectives. (p. III-23)
- 05 Maintain a medium to high edge contrast between tree stands created by even-aged management. (p. III-23)
- 06 Provide for conservation pools, and as appropriate, recreation facilities to meet resource protection needs in projects for new reservoir construction or reconstruction of existing reservoirs. (p. III-23)

Wildlife and Fish Cooperation with Other Agencies

Not Applicable. (p. III-23 to p. III-24)

Range Resource Management

- 01 Within the rangeland capability, provide forage to sustain the dependent livestock industry. (p. III-24)

- 02 Manage the range resource within its productive capabilities for grazing and browsing animals in harmony with other resources and activities to provide sustained yield and improvement of the forage resource. Encourage and coordinate other resource activities so as to maintain or enhance forage production. (p. III-24)
- 03 Manage livestock and wild herbivores forage use by implementing proper use criteria as established in the Allotment Management Plan. (p. III-24)

Range Improvement and Maintenance

- 01 Provide structural and non-structural range improvements needed to maintain or improve range conditions as specified in allotment management plans. (p. III-24)
- 02 Perpetuate non-commercial aspen communities as a forage source. (p. III-24)
- 03 Control and reduce noxious weeds and poisonous plants. (p. III-25)

Timber Resource Management

- 01 Manage timberlands suitable for commercial harvest for timber or wood fiber production. (p. III-25)
- 02 Provide for timber stand improvement, reforestation in sale area improvement plans, and wildlife habitat improvement. (p. III-25)
- 03 Manage timberlands not suitable for commercial harvest to maintain forest cover species, but emphasis should be on production of other forest resources and uses. (p. III-25)
- 04 Require those authorized to conduct activities to replace losses through appropriate mitigations where a site-specific development adversely affects long-term production or management. (p. III-25)
- 05 Use clearcuts as appropriate on any forest cover type with potential for impact, or impacted by insects or disease. (p. III-25)
- 06 Coordinate timber and fuelwood programs to take advantage of roads constructed for other resource development or use. (p. III-25)
- 07 Assure that even-aged conifer stands scheduled to be harvested during the planning period will generally have reached the culmination of mean annual increment of growth. (p. III-26)
- 08 Make Christmas trees available in areas where Christmas tree culture or other resource objectives can be accomplished through commercial or personal use Christmas tree sales. (p. III-26)

Silvicultural Prescriptions

- 01 Combine appropriate management activities for the timber type to provide the acceptable range of management intensity for timber production. (p. III-26)
- 02 Silvicultural treatments will normally begin after the stand density index reaches the lower management level and will be completed prior to reaching the upper management level. (p. III-27)
- 03 Manage timber product removal and utilization to meet Forest multiple use requirements. (p. III-28)
- 04 [There is no number 04 for Silvicultural Prescriptions.]
- 05 Perpetuate Aspen communities through silvicultural treatments. (p. III-29)

Reforestation

- 01 Establish a satisfactory stand on cutover areas, emphasizing natural regeneration within five years after final harvest. (p. III-29)
- 02 Do not apply final shelterwood removal cut until the desired number (as specified in minimum stocking standards) of well-established seedling/acre are expected to remain following overwood removal. (p. III-30)
- 03 When supplemental planting, use trees of the best genetic quality available which are adapted to the planting site. (p. III-30)

Water Quality Management

- 01 Improve or maintain water quality. (p. III-30)
- 02 Implement best management practices relative to water quality in all resource activities. (p. III-30)

Municipal Watershed Management

- 01 Manage municipal watersheds for multiple-use with mitigation measures to protect the water supply for intended purposes. Allow projects when the proposed mitigation measures provide adequate protection. (p. III-31)

Riparian, Floodplain and Wetlands Management

- 01 Prior to implementation of project activities, delineate and evaluate riparian areas and or wetlands that may be impacted. (p. III-31)
- 02 Give preferential consideration to riparian area dependent resources in cases of unresolvable resource conflicts. (p. III-31)
- 03 Floodplains should be identified and, as appropriate, a risk/hazard analysis performed for project sites where long-term occupancy is proposed. (p. III-31)
- 04 Protect present and necessary future facilities that cannot be located out of the 100-year floodplain by structural mitigation. (p. III-31)

Soil and Water Resource Inventories

- 01 Complete appropriate order of soil and water resource inventories to provide data for Forest activities and uses. (p. III-31)
- 02 Protect snow courses from site modification. (p. III-31)

Soil and Water Resource Management

- 01 Maintain or improve soil productivity and watershed qualities within the ecological site capabilities. (p. III-31)
- 02 Minimize adverse, man-caused impacts to the soil resource including accelerated erosion, compaction, contamination, and displacement. (p. III-32)

Soil and Water Resource Improvements

- 01 Rehabilitate disturbed areas, where feasible, that are eroding excessively and/or contributing significant sediment to perennial streams. (p. III-32)
- 02 Maintain completed watershed improvement projects until project objectives have been obtained. (p. III-32)
- 03 Identify, prescribe, and implement appropriate action before, during, and after landslide and/or flood events. (p. III-32)

Water Yield Improvement

- 01 Pursue water yield augmentation when and where research has shown that it is economical and environmentally sound. During the interim, water yield increases will be incidental to other management projects. (p. III-32)
- 02 Analyze the manipulation of forest types, when significant projects are proposed by other activities, for water yield benefits and impacts. (p. III-33)

Water Uses Management

- 01 Secure favorable flows of water. (p. III-33)
- 02 Obtain through the State, where appropriate, water rights for consumptive uses and instream flows as needed for the purposes of National Forest management. (p. III-33)
- 03 Maintain instream flows to protect Forest resources and uses. (p. III-33)

- 04 Prohibit new or expansion of existing spring or other water source development and related facilities when unacceptable effects would occur. (p. III-33)

Soil and Water Resource Improvement Maintenance

- 01 Provide for maintenance of soil and water resource improvement projects to meet objectives. (p. III-34)

Geologic Resources Management

- 01 Complete appropriate order of geologic inventory and as appropriate geotechnical investigation. (p. III-34)
- 02 Monitor identified geologic hazards for effects on management activities. (p. III-34)
- 03 Describe, as appropriate, high interest or unique geological, paleontological, biological, archeological, or historical features for public information and, as appropriate, develop interpretive information for these sites. (p. III-34)
- 04 Assure that appropriate geotechnical and/or geologic data are included in design and construction of facilities, or other developments so as to minimize the potential of inducing failure. (p. III-34)

Minerals Management, General

Not Applicable. (p. III-34 to p. III-35)

Mining Law Compliance and Administration

Not Applicable. (p. III-35)

Minerals Management, Leasables

Not Applicable. (p. III-35 to p. III-36)

Minerals Management, Saleables

Not Applicable. (p. III-36)

Special Use Management (Non-Recreation)

Not Applicable. (p. III-37)

Right-of-Way and Land Adjustments

Not Applicable. (p. III-37 to p. III-38)

Withdrawals, Modifications and Revocations

Not Applicable. (III-39)

Property Boundary Location

Not Applicable. (III-39)

Transportation System Management

- 01 Close newly constructed intermittent local roads to the public after initial intended use is completed when:
- A. The establishment of public use is undesirable;
 - B. The road is unsafe for public travel;
 - C. Management direction has previously been established to close the road. (p. III-39)
- 02 Allow commercial or permitted use on Forest Development Roads under the following conditions:
- A. Use is compatible with existing road standards, designs and public safety and user provides commensurate share of road maintenance;
 - B. User reconstructs the road to incorporate both existing uses and proposed traffic and provides commensurate share of road maintenance;
 - C. If the road meets design standards but the combined use does not fulfill public safety requirements due to volume of traffic, the road may be administratively managed to control conflicting traffic, unsafe conditions or traffic flows. (p. III-39 to p. III-40)

- 03 Encourage the development of Forest Development Roads, when constructed or reconstructed for special purposes to meet existing and potential all purpose needs. (p. III-40)

- 04 Put roads under special-use permit or easement that are needed for the benefit of private uses, and are not needed for public travel or the administration of Forest resources. (p. III-40)

- 05 Consider turning existing Forest Development Roads over to county or State jurisdiction in specific circumstances. (p. III-40)

- 06 Close Forest Development Roads when unacceptable environmental or road damage is occurring as a result of road use. (p. III-40)

- 07 Where possible, establish cost and commensurate share agreements for access roads constructed for other resource uses. (p. III-40)

- 08 Coordinate transportation planning for Forest Development Roads with Forest Trails to provide continuity and fulfill Forest transportation needs. (p. III-40)

Arterial and Collector Road Construction and Reconstruction

- 01 Construct and reconstruct arterial and collector roads to meet multiple resource needs and specified standards. (p. III-41)

Local Road Construction and Reconstruction

- 01 Construct and reconstruct local roads to provide access for specific resource activities such as campgrounds, trailheads, timber sales, range allotments, leases, etc., with the minimum amount surface disturbance and fitting the road to the topography. (p. III-41)
- 02 Construct temporary roads for specific resource activities such as timber sales, emergencies, (e.g., fire suppression), or mineral exploration. (p. III-41)

Road Maintenance

- 01 Maintain roads to minimum requirements. (p. III-42)
- 02 Maintain structures, bridges, cattleguards, etc., to be structurally sound and safe for use. (p. III-42)

Trail System Management

- 01 Maintain trails for designated uses and close trails to inappropriate uses. (p. III-42)
- 02 Provide a full range of trail opportunities. (p. III-42)

Trail construction and Reconstruction

- 01 Construct or reconstruct trails when needed as part of the transportation system. (p. III-42)

Facility Construction, Reconstruction and Maintenance

Not Applicable. (III-42)

Fire Planning and Presuppression

- 01 Provide a level of protection from wildfire that is cost efficient and that should meet objectives of the management unit. (p. III-42)

Initial Attack and Fire Suppression

Not Applicable. (p. III-43)

Fuel Treatment

- 01 Maintain fuel conditions which permit fire suppression forces to meet protection objectives for the Management Unit. (p. III-43)

Vegetation Treated by Burning

- 01 Use preplanned prescribed fire resulting from planned or unplanned ignitions to accomplish resource management objectives, such as reducing fuel load buildup, range/wildlife habitat improvement, etc. (p. III-43)

Air Resource Management

- 01 Meet State and Federal air quality objectives. (p. III-43)

Insect and Disease Management or Suppression

- 01 Prevent or suppress epidemic insect and disease populations that threaten forest and/or range land with an Integrated Pest Management approach consistent with resource management objectives. (p. III-43)

II. MANAGEMENT UNIT DIRECTION

Management Unit direction is supplemental direction specific to specified areas. Management Unit direction supersedes Forestwide general direction for the applicable area.

There are six Management Units within the project area: Range Forage Production, Wood Fiber Production and Utilization, Riparian Management Unit, Undeveloped Motorized Recreation Sites, Developed Recreation Sites, and Watershed Protection and Improvement.

Since the majority of the project area (98%) is in the Range and Forage Production Management Unit (77%) and the Wood Fiber Production and Utilization Management Unit (21%), the following excerpts are the Management Unit direction for these areas. This list reflects an itemization of all the direction for these management units, as indicated by resource topic and numbering. To reduce the length of this appendix, additional explanations included in the Forest Plan are omitted here.

RANGE FORAGE PRODUCTION MANAGEMENT UNIT DIRECTION**Dispersed Recreation Management**

- 01 Semiprimitive nonmotorized, semiprimitive motorized, roaded natural and rural recreation opportunities may be provided. (p. III-65)
- 02 Temporarily closed dispersed area camping sites to recreation use where resource damage is occurring or management of livestock is seriously impaired. (p. III-65)

Wildlife and Fish Resource Management

- 01 Balance wildlife use with grazing capacities and habitat. (p. III-65)

Range Resource Management

- 01 Improve or maintain range condition to fair or better. (p. III-65)
- 02 Balance livestock obligations and use with grazing capacities. (p. III-65)

Timber Resource Management

- 01 Maintain and manage non-commercial forested inclusions to provide a high level of forage production, wildlife habitat, and diversity. (p. III-65)
- 02 Use mechanical, chemical, or prescribed fire to alter timber stands and increase herbaceous yield or cover in areas where harvest methods are impractical or demand does not exist. (p. III-65)
- 03 Manage aspen stands or mixed fir habitat types at the appropriate ecological stage that provides high herbaceous yield and cover. (p. III-65)

Minerals Management General

- 01 Provide appropriate mitigation measures to assure continued livestock access and use. (p. III-66)
- 02 Those authorized to conduct developments will be required to replace losses through appropriate mitigations, where a site-specific development adversely affects long-term production or management. (p. III-66)

WOOD FIBER PRODUCTION AND UTILIZATION MANAGEMENT UNIT DIRECTION

Dispersed Recreation Management

- 01 Semiprimitive nonmotorized, semiprimitive motorized, roaded natural and rural recreation opportunities may be provided. (p. III-68)
- 02 Prohibit recreation use (including snowmobiles, vehicular travel, cross-country skiing etc.) where needed to protect forest plantations. (p. III-68)

Range Improvement and Maintenance

- 01 Protect regeneration from unacceptable livestock damage. (p. III-68)
- 02 Utilize transitory forage that is available where demand exists, and where investments in regeneration can be protected. (p. III-68)

Transportation System Management

- 01 Locate, design and construct the minimum Forest Development Road necessary to provide a stable road base to serve short- and long-term timber needs, under the timber sale program. (p. III-68)
- 02 To the extent possible, give emphasis to and coordinate road locations for timber sales that will benefit future fuelwood sales and other timber activities. (p. III-68)

Initial Attack and Fire Suppression

- 01 Control wildfires in Engelmann spruce types and in young ponderosa pine stands. (p. III-68)

APPENDIX D
PROJECT DESIGN
FEATURES

APPENDIX D - PROJECT DESIGN FEATURES

This appendix has three parts: D-1 (Project Design Features by Issue); D-2 (Best Management Practices); and D-3 (Monitoring).

D-1 PROJECT DESIGN FEATURES BY ISSUE

All action alternatives include design features that would better implement the project. All applicable Forestwide and Management Unit direction identified in the Forest Plan are hereby incorporated by reference unless otherwise stated. The following project design features are listed by issue topic.

Features Responsive to Issue #1 - Air Quality

- Use techniques to minimize smoke production and impacts from prescribed burning:
 - 1988 Memorandum of Understanding between State of Utah Air Conservation Committee and the Forest Service.
 - Follow guidance in Manti-La Sal National Forest Smoke Management Guideline for Prescribed Fire.
 - Pending Statewide Implementation Plan.
 - Develop a burn plan prior to prescribed burning.
 - Clearing Index.
 - Burn when conditions are good for rapid dispersion.
 - Burn under favorable moisture condition.
 - Keep soil out of burn piles.
 - Notify area users of activity.

Features Responsive to Issue - Land Stability

- Complete appropriate geologic inventory and, geotechnical investigations. (FP, III-34)
- Include appropriate geotechnical and/or geologic data are included in project design. (FP, III-34)
- Confine operations to dry conditions or wintertime, typically the dry field season is July 1st to October 1st.
- Do not locate log decks at the heads of existing landslide areas.
- Avoid, where practical, road construction/reconstruction and staging areas on lands classified unstable or moderately unstable, slopes greater than 40 percent, and existing landslides. Where avoidance is not practicable, locate and design facilities to minimize landslide risk (changes to topographic and drainage conditions).

Features Responsive to Issue #3 - Soil Erosion and Productivity

- Take measures to revegetate disturbed sites within one season after termination of the activity. Add mulch, fertilizer, and other soil amendments as necessary (FP, III-32).
- Confine operations to dry conditions or wintertime, including intermittent storm events. The usual dry field operating season is July 1st through October 1st. Generally, soils are too wet when equipment creates 6-inch ruts. Roads are too wet when ruts are 2 inches deep on aggregate surfaced roads and 3 inches deep for native surfaced roads.

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- Maintain 10 to 15 tons per acre of woody debris to maintain soil productivity. Use C(T)6.73# - Recruitment Of Large Woody Debris to assure retention of large woody material (material greater than 3 inches in diameter). Materials should be evenly distributed over the area. At least 25 percent of the material should be greater than ten inches in diameter. It is desirable to have the materials in varying degrees of decomposition.
- Apply Best Management Practices (identified in Part D-2) to all road construction and timber sale activities.
- Scarify areas having severe compaction after use.
- Prescribed burning would be conducted so as to not adversely impact the soil resource (i.e. mar.age fine intensity to obtain desired results).

Features Responsive to Issue #4 - Water Resources

Quantity

- Protect water developments (diversion ditches, data stations, stock tanks, etc.).
- Water use must comply with applicable water laws.

Quality

- Apply Best Management Practices, as identified in Part D-2, to assure compliance with applicable water quality protection regulations.
- Place logging slash and large woody debris on skid trails following harvest.
- Prior to preparation of the timber sale contract, a Hydrologist and Presale Forester will visit the sale and prescribe site specific Soil and Water Conservation Practices that will be included in each sale contract.
- Stabilize and reseed helicopter landing areas when management activities have finished.

Riparian/Wetlands, Floodplains

- No harvesting or mechanical entry (e.g. skidding) will be permitted within 100 feet of each perennial stream bank, seep, lake, reservoir, or wetland, unless otherwise agreed to. Where avoidance is not possible, rehabilitation is included.
- Except where crossing are agreed to, protect intermittent streams with no harvest within 35 feet, and no mechanical entry (e.g. skidding) within 50 feet.
- Where practical, there will be no road or landing construction within riparian areas.
- Where roads must cross the RPN unit, they will cross as nearly perpendicular to the riparian area as practicable.
- Landings within RPN areas will be approved by consultation with a soils person, as additional protection and rehabilitation measures may be necessary.
- Wetlands are managed under the guidance of Executive Order (E.O.) 11990 and FSM 2527. Wetlands regulations are enforced by the Army Corps of Engineers and Environmental Protection Agency. The general exemption of silvicultural activities will apply because the following mitigations will be implemented:
 - Wetlands will be avoided whenever possible. No wetland will be converted to a dry land. Where wetlands cannot be avoided, the following mitigations will be applied.
 - Any changes in the location of the drainage as a result of log skidding will be restored as soon as the skidding operations in the wetlands are complete, or at the end of the harvesting season whichever is first.

- Road crossings will be designed so that the length of waters is not reduced and any adverse effect on aquatic environment will otherwise be minimized.
- Road construction and maintenance in wetlands will be accomplished in accordance with Best Management Practices.
- Floodplains are regulated by E.O. 11988 and FSM 2527. Where the plans show that a road, landing, or other facility will be placed near a stream, the instantaneous peak flows for the 100 and 500 year floods will be estimated. With this information, an Interdisciplinary Team and Sale Administrator will visit the site and identify the limits of each floodplain. If necessary, the facility will be moved out of the 100 year floodplain unless no practicable alternative exists. If the planned activity includes the storage of petroleum products or hazardous materials, the facility and activity will be moved out of the 500 year flood plain. No facility will be developed within the 100 year flood plain unless it is a culvert, bridge, or other functionally dependant facility (FSM 2527.32 item 1).

Aquatic Habitat

- Macroinvertebrates - The diversity index DAT (DAT combines measurements of the number of taxa and biomass as an indication of diversity) will be maintained at or above 11, the standing crop at or above 1.6, and the biotic condition index at or above 75 (FP, III-20). One station for sampling is at the mouth of Duck Fork Creek (established in 1995). Monitoring of this station is part of Forest-level monitoring. If DAT and Standing Cup and biotic conditions fall below set levels then evaluation of cause of sediment source would be done and corrective measures taken as soon as possible.
- Prior to contract, all perennial streams crossed by proposed roads will be reviewed by a Fish Biologist and Engineer to determine appropriate fish passage structures. The State of Utah Division of Wildlife Resources will be invited to such reviews.
- Manage stream habitat to at least 50% of potential where existing self-sustaining fisheries occur (FP, III-22).

Threatened, Endangered, and Sensitive Aquatic Species.

- Where activities or uses may impact threatened or endangered species or their habitats, consult with the U.S. Fish and Wildlife Service. Include the results of consultation in determining the viability of the activity or use.

Features Responsive to Issue #5 - Vegetation Resource

Forest Health, Diversity, and Productivity

- All non-dying spruce trees and dead Douglas-fir trees would not be harvested.
- Timber Sale Contracts will be developed using the Intermountain Region's approved C(T) provisions for 2400-6(T) contracts and Special Provisions for 2400-3(T) contracts. Other permits that may be used are the Forest Product Permit (2400-14), fuelwood permit, free-use permit, and administrative use permit.
- Locations for temporary roads, log landings, and skid trails would be approved as specified in the Timber Sale Contract provisions. Generally, log landings for ground-based operations would be located along harvest access roads every 1/8th to 1/4th mile. Log landing and decking areas would likely be less than 1/2 acre in size for ground-based yarding areas and less than 2 acres in size for helicopter yarding units.
- Special Provisions C(T)6.410# - Felling And Bucking, C(T)6.411# - Directional Felling, C(T)6.425# - Tractor Or Rubber Tired Skidding Restrictions, C(T)6.426 - Tractor Restrictions, and C(T)6.428# - Maximum Product Length For Skidding And Yarding would be included in the Timber Sale Contract to provide protection measures for live residual tree stands.
- Special operation instructions to close and stabilize temporary work roads, skid trails, and landings will be listed in the following C(T) provisions.
 - C(T)6.6# - Erosion Prevention And Control.

1. Cross ditches as specified in C(T)6.601# - Diagrams And Specifications For Cross-Ditch Construction. Use Form R4-2400-36 for diagram.
 2. Outsloping and berm removal as specified in C(T)6.603# - Specifications for Outsloping and Berm Removal (Machine Construction). Location of work will be designated on the ground by flagging.
 3. Erosion control seeding as specified in C(T)6.607# - Erosion Control Seeding. The seed mixture must be certified to have a minimum of 90% pure live seed (PLS) and a maximum of 1% weeds, none of which are noxious. Apply seed at the rate of 9 pounds per acre or heavier to the disturbed sites that are most likely to produce runoff and soil loss. Sites less likely to produce runoff or lose soil may be lightly seeded with 2 to 4 pounds per acre.
 4. Scarification as specified in C(T)6.608# - Scarification Of Temporary Roads And Landings.
 5. Other erosion control requirements will be implemented as required to meet individual stand or road conditions or needs (i.e. water retention dams, hand constructed water bars, hand constructed cross-ditches, hand constructed brush dams, seeding of specified roads).
- C(T)6.7# - Slash Disposal.
1. Purchaser shall machine pile landings, lop limbs and tops (to a 3 inch DIB (Diameter Inside Bark)), and lop and scatter logging slash through all cutting units so slash depths are no more than 24 inches high.
 2. Other C(T)6.7# slash disposal requirements will be implemented as required to meet individual stand or road construction conditions or needs, and will be prescribed by a Silviculturist or Engineer (i.e. construction of fire-lines, slash piling other than landings, chipping, bury slash, fell damaged trees, fell or push over residual stands, firebreaks, Purchaser burn slash, construct slash free strips by dozer along contour lines, disposal of peeling residues, scatter slash away from leave trees that are 8 inches DBH (Diameter Breast Height) and larger.
- No firewood gathering in harvest areas during contract operations.
 - Include C(T)6.25# Protection of Habitat of Endangered Species.
 - C(T)6.24# Protect Cultural Resources.
 - Silvicultural release and weed activities will be implemented after harvest in units to improve stand health, promote diameter and crown growth and development, improve species diversity and distribution, reduce encroachment of less desirable species on desirable species (aspen, Engelmann spruce, Douglas-fir, and limber pine), and meet short and long-term resource objectives.
 - Reforestation activities will be prescribed and monitored by a Silviculturist.
 - Reforestation of harvest areas will be accomplished by natural regeneration, or by hand planting bareroot seedlings or containerized seedlings grown from seed collected from appropriate seed sources. Site preparation tools for reforestation activities may include machine scarification, hand scarification, and prescribed fire.
 - Where aspen occurs within the harvest areas, reforestation measures would favor aspen regeneration through sprouting. Spruce seedlings would not be planted within the fringe area around existing aspen clones. The width of the fringe area should not exceed the height of the dominant aspen trees in the clone or 2/3 the height of the surrounding conifer trees. If aspen sprouting does not naturally occur where expected after harvest, mechanical preparation or prescribed fire may be used as part of post-harvest treatment of slash to further stimulate sprouting.
 - 10 to 15 tons per acre of large (> 3") woody debris will be maintained on site to protect soil productivity and to provide microsite protection for seedling establishment and protection.
 - Where site conditions allow, reforestation stocking objectives will meet or exceed Forest Plan stocking standards (FP, III-27).
 - Reforestation (plantation) investments will be protected. FSH 2409.26b (C(T)6.04-Responsibility) states that "A decision to regenerate any vegetation manipulation project is also a decision to protect the investment." In

- accordance with this, potential plantations will be reviewed by a Silviculturist. After coordination with appropriate range or wildlife management, personnel, prescriptions will be implemented which provide appropriate protection of investments. Plantation protection and/or monitoring activities will continue until stated silvicultural objectives are met (FSH 2409.26b, C(T)6.31 - Protection).
- Appropriate protection activities may include exclusion of livestock from plantations through fencing or allotment administration (rest rotation, closure, herding practices, or salt placement), and underground strychnine baiting of burrows in and around planted areas to reduce pocket gopher populations.
 - Plan post-work projects in the Sale Area Improvement Plan (KV (Knutson-Vandenberg)) and collect erosion control deposits to complete the work where possible. If KV funds are not available, projects will be programmed and appropriated funds requested. Annual maintenance and removal of protection structures (i.e. fences) will be included in the funding process.
 - Native plant species and species which discourage pocket gopher activity are preferred for revegetating landings, skid roads, temporary roads, or other disturbed areas. Species composition, including tree species in the Range management units, will be reviewed by silviculturists, vegetation management specialists, and wildlife biologists to determine appropriate species mixes.

Noxious Weeds

- Continue control of noxious weeds with existing decisions and agreements.
- Special Provision C(T)6.26# - Noxious Weed Control will be used to prevent the potential spread of noxious weeds into harvest units. Timber purchasers would be required to furnish proof of weed-free equipment. If available, KV funds would be collected to treat any noxious weeds that may invade disturbed areas following operations.

Threatened Endangered and Sensitive Plant Species:

- Where activities or uses may impact sensitive plant species or their habitats, initiate the following procedures:
 - No harvesting within riparian zones.
 - Habitats and known population sites will be surveyed prior to harvest activities to determine distribution of plants.
 - Plants and habitat identified will be marked, staked out, and flagged to identify the areas where no project activity will occur.
 - Where appropriate, barriers may be placed to prevent project equipment and personnel from disturbing sensitive plants and their habitat.
 - No gravel will be taken from the steep slopes where sensitive plants exist within the gravel source area.
 - Advancement of the South Camel gravel pit to the north would be prohibited.

Features Responsive to Issue #6 - Fuel Loading and Fire Risk

- Slash, substandard, and cull material left at landings would be piled or scattered by the timber purchaser. Areas of heavy slash concentrations throughout the units would be either machine and/or hand piled by the timber purchaser and burned by Forest Service personnel, or jackpot burned by Forest Service personnel. Fuelbreaks may be constructed within and/or around treatment units. Deposits needed to complete this work would be collected through the brush disposal plan.

Features Responsive to Issue #7 - Wildlife Resources

Management Indicator Species

- Maintain adequate elk hiding cover within elk calving areas (primarily aspen) and re-establish security cover where needed (primarily in conifer sites) to reduce vulnerability (FP, III-19).

- Where clones exist, promote aspen to provide forage and cover for wildlife (FP, III-23, 29).
- Where calving/fawning areas are identified, harvesting activities will not occur between May 15th and July 5th.
- All harvest activities are prohibited during the first 9 days and the day before opening day of the general rifle elk hunt; harvest activities may occur during the last 4 days of the general rifle elk hunt; all harvest activities are prohibited during the first two days of the general rifle deer hunt, and no hauling the day prior to the season opener.
- Temporary project roads closed to public through closure order and signing.
- Across the project area, maintain a forage ratio within the range of the Forest Plan Standards and Guidelines: 25% hiding, 15% thermal, 10% hiding or thermal, and 50% forage.
- Maintain a cover forage ratio of 50-to-50.
- Maintain and/or improve habitat suitable for blue grouse to provide a mix of 10% breeding, 20% brood rearing, 40% feeding and 30% wintering (FP, III-20).
- Treatment of gophers will occur only where needed using underground methods.
- Manage vegetative composition (habitat diversity) across the project area to maintain at least 50% of current (current when the Forest Plan was approved) habitat for existing and approved introduced wildlife species (FP, III-22).
- Known raptor nest sites will be protected during the nesting season period from March 1 - Aug 31. Raptor nests found during harvest activities will require operators to notify the Forest Service for further evaluation.
- No nest trees with cavities will be harvested.
- Provide 50 logs per 10 acres within the project area. Minimum log size of 12 inches in diameter at the mid-point and 8 feet in length.
- Retain slash on at least 10 percent of the area (FP, III-22).
- Retain 10-15 tons of woody debris/acre greater than 3 inches in diameter; including down logs.
- Where necessary and feasible, protect snags with surrounding vegetation (trees).
- Retain 300 snags per 100 acres with a minimum of 18 inches in diameter at breast height and 30 feet in total height.
- Wildlife snag trees will be identified and protected from firewood harvest. Designate snags away from roads or locations otherwise protected from removal by firewood cutters.
- Winter hauling: If requested for winter use, the haul routes within wildlife winter ranges will be reviewed for travel access restrictions. Considerations will include current and predicted weather patterns and big game herd health and needs. The State of Utah Division of Wildlife Resources will be consulted in making the appropriate use determination.

Threatened Species

- Helicopter flights will not be allowed within 1/2 mile (site distance) of roosting Bald Eagles from October 1 through November 15.

Sensitive Species

- Goshawk - Implementation strategies will be followed per the Conservation Strategy and Agreement for the Management of Northern Goshawk Habitat in Utah. In addition to this, surveys for new nesting territories will be conducted in areas of suitable habitat the year prior to offering each sale and appropriate changes made if new nesting territories are found.

- Flammulated Owl - Along ridge tops and at mid-slope on south or east aspects in areas containing Douglas-fir mixed with spruce and/or aspen manage for the retention of all large snags containing cavities. In these same areas retain small pockets of dense vegetation where they exist.
- Three Toed Woodpecker - A minimum of 1 snag per acre within the harvest units will be retained.
- If possible retain and leave snags with broken tops.
- Spotted Bat - Manage for vegetative diversity across the landscape. Inventory limestone cliffs, mines, or caves where impacts may occur. No rock material will be disturbed from cliff faces. Pit blasting will not occur prior to surveys, with the Forest Service being notified of blasting 30 days in advance. If surveys identify roosting utilization, impacts will be reassessed and appropriate measures taken.
- Townsends Big-Eared Bat - Manage for vegetative diversity across the landscape. Inventory limestone cliffs, mines, caves, or old buildings where impacts may occur. No rock material will be disturbed from cliff faces. Pit blasting will not occur prior to surveys, with the Forest Service being notified of blasting 30 days in advance. If surveys identify roosting utilization, impacts will be reassessed and appropriate measures taken.

Features Responsive to Issue #8 - Transportation

- Temporary work roads shall be returned to resource production and use compatible with the management unit emphasis. Appropriate timber sale closures for erosion prevention and control and for reclamation of temporary roads would be incorporated into each contract.
- Allow commercial or permitted use on Forest Development Roads. If the road meets design standards but the combined use does not fulfill public safety requirements due to volume of traffic, the road may be administratively managed to control conflicting traffic, unsafe conditions or traffic flows (FP, III-40).
- Warning signs will be installed at the entrance to road construction or reconstruction projects, on Forest Development Roads used for timber haul, at the junction of Forest Development Roads and work roads, and near dispersed camp areas 1/4 mile from logging operations. If necessary, traffic controllers (flaggers) will be used.
- Vehicle Access Restrictions and Operating Season Restrictions: Vehicle access restrictions will remain in effect as shown on the 1990 Forest Visitor/Travel Map, as amended.
- Hauling logs on weekends, holidays, during the first nine days of the general rifle elk hunt, the first two days of the general rifle deer hunt, and the day before general rifle deer and elk seasons will be prohibited. The dates of hunts will be established by the State Division of Wildlife Resources. These restrictions would be identified in timber sale contract.
- Preclude hauling on weekends and federal holidays.
- Winter hauling will be negotiated and approved annually based on safety, road damage, and resource protection (see wildlife design features).
- Where possible locate/construct work roads to facilitate closure which will minimize unauthorized use.
- Preclude public use of newly constructed project and temporary roads to keep the public from becoming accustomed to driving to certain areas that were not accessible with vehicles prior to the road construction. Implement by closure order and signing, after project use consider signing, berms, felling trees, etc.
- System roads will be located, designed, and constructed for short and long term timber needs, including fuelwood sales (FP, III-68).
- Hauling will be suspended whenever conditions could compromise the road investment or public safety.
- Close newly constructed project roads to the public after initial intended use is complete when the establishment of public use is undesirable or management direction has previously been established to close the road (FP, III-39).

- Reclaim nonsystem roads in and adjacent to the project that will not be used for logging activities and are not needed for future resource management. These roads would be reclaimed over a period of 10 to 15 years as funding becomes available. They number approximately 18 miles and are dispersed throughout and adjacent to the project area.
- Dust abate haul roads as needed.

Features Responsive to Issue #9 - Range Allotments and Improvements

- Coordinate grazing and timber activities. Timber Contracting Officer will send a copy of the general operating plans to range specialists to help facilitate this coordination.
- Maintain and protect all range improvements. The timber sale operator will be responsible to repair any damages they cause, in a timely manner.
- Livestock grazing would be discouraged within reclaimed roads for two to three seasons to allow grass (for erosion control) to become established. Grazing could be discouraged by resting an entire unit, herding techniques, animal husbandry, salting, and seed mixes not attractive to livestock.
- In the harvest units, grazing may be prohibited until spruce and fir regeneration reaches a minimum average height of 4 feet. This height should be attained within 15 to 20 years. This may require fencing in some situations that will be maintained by appropriated funds. If long-term reductions are necessary, they will need to be coordinated with the permittees at least two years in advance in order for the permittee(s) to make arrangements for the excess livestock.

Features Responsive to Issue #10 - Visual Landscape

- Employ techniques such as feathering, leave trees, shaping cuts to duplicate naturally occurring open pockets, or aspen clones in the area, which alleviate unnaturally appearing geometric lines and forms.
- When practical, avoid skylining salvage related disturbance. Objects or unnaturally appearing forms become greatly exaggerated when in silhouette on the horizon; particularly when contrasted against a blue-sky or moon-lit background.
- Where practical, angle skidding and logging road corridors away from Forest Development Roads and major trails and align them as close to the natural contour as possible to prevent direct views down these corridors.
- Where necessary to meet Forest Plan visual quality standard, remove or visually screen from view, salvage-created slash which may be readily recognized within the immediate foreground view.
- Where practical, directionally fell trees away from roads and trails and cut trees at a slant (low to the ground) positioning the exposed cut to face away from the trail or road.
- Landscape/Recreation Specialist and Presale Forester will visit the project area and identify visually sensitive areas to be included in the contract and apply the appropriate contract provisions (see B(T)6.412, C(T)6.7).

Features Responsive to Issue #11 - Undeveloped Character

- Use of constructed project roads would be open to public, unless specified authorization exists. Closure would be by closure order and signed.

Features Responsive to Issue #12 - Cultural Resources

- Implement the Memorandum of Understanding with Utah State Historic Preservation Office (SHPO) and Advisory Counsel. Implementation of the operating plan (Project File) in-part includes:
- Conduct inventories of all harvest units, landings, road construction and reconstruction, and other associated activities prior to timber sale and road contracts.

- Evaluate and protect in-place all National Register eligible sites.
- When in-place protection is not possible, modify proposed activities to avoid, mitigate, or minimize impacts in consultation with the SHPO and Advisory Council.
- Where project activities cannot be modified to protect sites in-place, develop plans to recover scientific data in accordance with the National Resources Protection Act, Archaeological Resources Protection Act, and the Native American Graves Repatriation Act.
- Discovery of previously unknown sites, either on the surface or subsurface, may occur during project implementation. The Timber Sale Contract includes a provision for Protection of Cultural Resources (either C6.24 or CT 6.24). These provisions state that the discovery of any cultural resource sites during project implementation would require mitigation or avoidance.
- Consult with appropriate Native American entities.

Features Responsive to Issue #13 - Economics

- Timber sales will be developed and offered for sale based on many factors including volume locations, economics, harvest methods, road construction requirements etc.

Features Responsive to Issue #14 - Energy

- None

Features Responsive to Issue #15 - Roadless Character

- Use of constructed project roads would be open to public, unless specified authorization exists. Closure would be by closure order and signed.

D-2 BEST MANAGEMENT PRACTICES

Description of the soil and water conservation practices from the Forest Service Soil and Water Conservation Handbook (FSH 2509.22) will be applied in all alternatives. Refer to the Soil and Water Conservation Handbook for more information regarding any specific Best Management Practice (BMP).

Abbreviations used in this table: SPS = Special Project Specification TSC = Timber Sale Contract
PSF = Pre-sale Forester TSA = Timber Sale Administrator
ER = Engineering Representative SMZ = Streamside Management Zone
IDT = Interdisciplinary Team SAM = Sale Area Map
COR = Contracting Officer's Representative
MC = Marking Crew

SWCP	SWCP OBJECTIVE	CONSIDERATIONS FOR BEST MANAGEMENT PRACTICES	PERSON(S) RESPONSIBLE	CONTRACT PROVISION
14.01	TIMBER SALE PLANNING - To incorporate soil and water resource considerations into Timber Sale Planning.	IDT will evaluate watershed characteristics and estimate response to proposed activities. NEPA process identifies design criteria intended to protect soil and water resources. Timber sale contract will include provisions to meet water quality, soils, and other resources as directed by the Decision.	IDT, PSF, TSA	N/A
14.02	TIMBER HARVEST UNIT DESIGN - To insure timber harvest unit design will secure favorable conditions of water flow, maintain water quality and soil productivity, and reduce soil erosion and sedimentation.	Proposed activities will be evaluated to estimate the potential watershed response in the decision document. Prescriptions will be designed to assure an acceptable level of protection for soil and water resources. Management will protect soil/water values by avoiding sensitive areas, adjusting unit boundaries, adding specific BMPs to meet specific SWCPs, implementing the Manti-La Sal National Riparian Area Guidelines, applying mitigation, and applying implementation/effectiveness monitoring.	IDT	N/A
14.03	USE OF SALE AREA MAPS (SAMs) FOR DESIGNATING SOIL AND WATER PROTECTION NEEDS - To delineate the location of protected areas and available water sources and insure their recognition, proper consideration, and protection on the ground.	The IDT will identify water courses to be protected, unit boundaries and other features required by other means such as "C" provisions. Ground verification and preparation of SAMs to be included in TSC will be done by Pre-Sale Forester. TSA reviews areas of concern with purchaser before operations.	IDT, PSF, TSA	BT5.1 BT5.5 CT5.5 BT1.1
14.04	LIMITING THE OPERATION PERIOD OF TIMBER SALE ACTIVITIES - To minimize soil erosion and sedimentation and loss in soil productivity by insuring the purchaser conducts his/her operations in a timely manner.	IDT has identified seasonal restrictions and limitations on sensitive ground. Pre-sale forester will prepare a TSC that includes the appropriate provisions to prevent loss of soil/water resources.	IDT, PSF, TSA	BT5.31 BT5.6 CT5.3 CT5.6
14.05	PROTECTION OF UNSTABLE AREAS - To protect unstable areas and avoid triggering mass movements of the soil mantle and resultant erosion and sedimentation.	IDT has identified unstable areas and mitigation measures in NEPA process. Mitigation measures will be incorporated into TSC.	IDT, PSF, TSA	BT5.6 CT5.3
14.06	RIPARIAN AREA DESIGNATION - To minimize the adverse effects on riparian areas with prescriptions that manage nearby logging and related land disturbance activities.	All streams and wetlands in the decision area will comply with Manti-La Sal Riparian Area Guidelines. The width of the riparian areas will be decided upon by the IDT. These widths will be included on the sale area map and marked on the ground. This information will be included in the timber sale contract.	IDT, PSF, MC, TSA	BT5.5 CT5.6 CT5.5 CT5.50
14.07	DETERMINING TRACTOR LOGGABLE GROUND - To protect water quality from degradation caused by tractor logging ground disturbance.	IDT has identified tractor loggable ground (in conjunction with personnel from timber operations) during transportation and timber sale planning process. The results have been used to determine intensity of and restrictions for land disturbance activities. PSF will prepare a TSC that includes provisions stating areas and conditions by which tractors can operate.	IDT, PSF	CT5.4 BT5.42 CT5.6

SWCP	SWCP OBJECTIVE	CONSIDERATIONS FOR BEST MANAGEMENT PRACTICES	PERSON(S) RESPONSIBLE	CONTRACT PROVISION
14.08	TRACTOR SKIDDING DESIGN - To minimize erosion and sedimentation and protect soil productivity by designing skidding patterns to best fit the terrain.	IDT has identified sensitive areas during the planning process. The TSA will execute the plan on the ground by logging the skid trails with the timber purchaser or by agreeing to the purchaser's proposed locations prior to operation.	IDT, TSA	BT5.422 CT5.6 CT5.4 BT5.6 BT5.42
14.09	SUSPENDED LOG YARDING IN TIMBER HARVESTING - To protect the soil from excessive disturbance and accelerated erosion and maintain the integrity of the riparian and other sensitive areas.	IDT has identified cable ground requiring one end suspension. PSF will prepare a TSC that includes provisions stating areas and conditions needing one end suspension. Jammer logging within 300 feet of roads will be permitted, which does not have one end suspension.	IDT	BT5.422 CT5.4 CT5.6
14.10	LOG LANDING LOCATION AND DESIGN - To locate in such a way as to avoid soil erosion and water quality degradation.	TSA must agree to landing locations proposed by the purchaser. Approved landing locations will meet the criteria of minimal size, least excavation needed, minimum skid roads necessary, no side-cast material into sensitive areas, and proper drainage.	TSA	BT5.422 CT5.6 CT5.4
14.11	LOG LANDING EROSION PREVENTION AND CONTROL - To reduce erosion and subsequent sedimentation from log landing through the use of mitigating measures.	PSF and TSA assesses what is necessary to prevent erosion from landing and to ensure stabilization. It is up to the TSA to request technical assistance as needed.	PSF, TSA	CT5.4 CT5.6 BT5.422 CT5.523 BT5.62 BT5.6
14.12	EROSION PREVENTION AND CONTROL MEASURES DURING THE TIMBER SALE OPERATION - To ensure that the purchaser's operations shall be conducted reasonably to minimize soil erosion.	PSF sets purchaser's responsibility to prevent soil/water resource damage in TSC. TSA ensures that erosion control is kept current and prevents operation when excessive impacts are possible.	PSF, TSA	CT5.4 CT5.6 CT5.503 CT5.523 BT5.62 BT5.4 BT5.55 BT5.66
14.13	SPECIAL EROSION PREVENTION MEASURES ON AREAS DISTURBED BY HARVEST ACTIVITIES - To prevent erosion and sedimentation on disturbed areas.	IDT has evaluated the locations needing special stabilization measures. IDT will recommend specific BMPs based on site surveys. BMPs may be adjusted by the TSA to meet operational requirements.	IDT	N/A
14.14	REVEGETATION OF AREAS DISTURBED BY HARVEST ACTIVITIES - To establish a vegetative cover on disturbed areas to prevent erosion and sedimentation.	IDT has established vegetation and fertilizer mix to be used in the project area with outlines on the extent to which it should be used. TSA is responsible to see that revegetation work required by purchaser is done correctly and in a timely manner. For this project, the purchaser will be responsible for revegetation immediately after the completion of harvest. Funds will be collected for the District to do follow-up seeding/fertilizing in years two and five after harvest.	IDT, TSA	BT5.6 CT5.01 CT5.507#
14.15	EROSION CONTROL ON SKID TRAILS - To protect water quality by minimizing erosion and sedimentation derived from skid trails.	IDT will identify areas where special concerns need to be addressed. TSA will ensure erosion control measures are applied prior to expected hydrologic events: spring runoff, high-intensity storms, etc.). Maintenance of erosion control structures by the purchaser may be necessary and requested by the TSA.	TSA	CT5.4 CT5.6 CT5.503 BT5.6 BT5.66 BT5.44 BT5.55 CT5.507#
14.16	MEADOW PROTECTION DURING TIMBER HARVESTING - To avoid damage to the ground cover, soil, and water in meadows.	IDT has identified areas needing special protection. PSF will verify the areas needing protection and prepares the contract to prevent damage to meadows. The TSA will be responsible for on the ground protection of meadows. If meadows are found by the TSA during operations, it is their responsibility to either affirm them the proper protection or pursue a contract modification.	IDT, PSF, TSA	BT5.51
14.17	STREAM CHANNEL PROTECTION (IMPLEMENTATION AND ENFORCEMENT) - To protect natural stream flows, to provide unobstructed passage of flows, reduce sediment input, and restore flow if diverted by timber sale activity.	IDT has identified the location of channels in the decision area. PSF will prepare a SAM locating the channels needing protection. TSA will see that TSC items are carried out on the ground. Technical assistance will be consulted as needed.	IDT, PSF, TSA	BT5.5 CT5.50 CT5.6 CT5.51 CT5.5

SWCP	SWCP OBJECTIVE	CONSIDERATIONS FOR BEST MANAGEMENT PRACTICES	PERSON(S) RESPONSIBLE	CONTRACT PROVISION
14.18	EROSION CONTROL STRUCTURE MAINTENANCE - To insure constructed erosion control structures are stabilized and working effectively.	During the period of the TSC, the purchaser is responsible for maintaining their erosion control features. If work is needed beyond this time, the District will pursue other sources of funding.	IDT; PSF; TSA	BT6.5 CT6.602 BT6.66
14.19	ACCEPTANCE OF TIMBER SALE EROSION CONTROL MEASURES BEFORE SALE CLOSURE - To assure the adequacy of required erosion control work on timber sales.	A careful review of erosion prevention work will be made by the TSA before each harvest unit is considered complete. The inspection will determine if the work is acceptable and will meet the objective of the erosion control feature. A feature is considered not acceptable if it does not meet standards or is not expected to protect soil/water values. Technical assistance will be used as necessary.	TSA	BT6.6 BT6.62 BT6.64 BT6.65 BT6.66 CT6.6 CT6.622 BT6.35
14.20	SLASH TREATMENT IN SENSITIVE AREAS - To protect water quality by protecting sensitive tributary areas from degradation which would result from using mechanized equipment for slash disposal.	All activities will comply with the MLS Riparian Area Guidelines in Forest Plan.	Fuels Specialist	BT6.5 CT6.5 BT6.7 CT6.7
14.22	MODIFICATION OF THE TSC - To modify the TSC if new circumstances or conditions indicate that the timber sale will cause irreversible damage to soil, water, or watershed values.	If TSC is not adequate to protect soil/water resources, the TSA and Contracting Officer are responsible for recommending a modification of the TSC.	TSA; Contracting Officer	BT8.3 CT6.3
15.01	GENERAL GUIDELINES FOR TRANSPORTATION PLANNING - To introduce soil and water resource considerations into transportation planning.	The IDT has evaluated watershed characteristics and has estimated the response of soil and water resources to proposed transportation alternatives and activities.	IDT; ER	N/A
15.02	GENERAL GUIDELINES FOR THE LOCATION AND DESIGN OF ROADS AND TRAILS - To locate and design roads and trails with minimal soil and water impact while considering all design criteria.	The IDT has insured that the location and design of roads and trails are based on multiple resource objectives. Mitigation measures have been designed to protect the soil and water resources identified in the NEPA process. Contract provisions will be prepared by the ER that meet the soil and water resource protection requirements.	IDT; ER	N/A
15.03	ROAD AND TRAIL EROSION CONTROL PLAN - To prevent, limit, and mitigate erosion, sedimentation, and resulting water quality degradation prior to the initiation of construction by timely implementation of erosion control practices.	IDT has established soil/water conservation objectives and mitigation measures. ER will then prepare a contract that reflects the objectives. ER will see that erosion control measures are approved and completed in a timely manner. IDT review of projects to check effectiveness of erosion control features.	IDT; ER	BT6.31 BT6.5 BT6.6 CT6.3
15.04	TIMING OF CONSTRUCTION ACTIVITIES - To minimize erosion by conducting operations during minimal runoff periods.	IDT has outlined detailed erosion control measures in NEPA process. ER puts these measures into contract provisions. Compliance is assured by Contracting Officer or ER.	IDT; ER	CT6.3 CT6.311 BT6.31 BT6.6
15.05	SLOPE STABILIZATION AND PREVENTION OF MASS FAILURES - To reduce sedimentation by minimizing the chances for road-related mass failures, including landslides and embankment slumps.	IDT has looked for areas susceptible to mass failures.	IDT; PSF; ER	BT6.31 BT6.6 CT6.3
15.06	MITIGATION OF SURFACE EROSION AND STABILIZATION OF SLOPES - To minimize soil erosion from road cut slopes, fill slopes, and travel ways.	IDT has outlined detailed erosion control measures in the NEPA process. Stabilization techniques are put into contract provisions. Compliance is assured by Contracting Officer or ER.	IDT; ER	BT6.31 BT6.6 BT6.62 BT6.65 BT6.66 CT5.2 CT5.23 CT5.4 CT5.441 CT5.46 CT6.36 CT6.52 CT6.6 CT6.601 CT6.622

SWCP	SWCP OBJECTIVE	CONSIDERATIONS FOR BEST MANAGEMENT PRACTICES	PERSON(S) RESPONSIBLE	CONTRACT PROVISION
15.07	CONTROL OF PERMANENT ROAD DRAINAGE - To minimize the erosive effects of concentrated water and the degradation of water quality by proper design and construction of road drainage systems and drainage control structures.	IDT has identified locations, design criteria, drainage control features, and mitigation. Compliance will be assured by the ER/Contracting Officer.	ER	BT5.4 BT5.41 CT5.4 CT5.42 BT6.6 CT6.3 CT6.6
15.08	PIONEER ROAD CONSTRUCTION - To minimize sediment production and mass wasting associated with pioneer road construction.	ER/Contracting Officer will be responsible for enforcing contract specifications. The purchaser is responsible for submitting an operating plan that includes erosion control measures.	ER; Contracting Officer	BT6.6 BT5.23 CT6.3 CT6.311
15.09	TIMELY EROSION CONTROL MEASURES ON INCOMPLETE ROADS AND STREAM CROSSING PROJECTS - To minimize erosion of and sedimentation from disturbed ground on incomplete projects.	IDT has identified project location and mitigative measures in NEPA process. Protective measures will be kept current on all areas of disturbed, erosion-prone areas. TSA ensures contract compliance.	IDT; TSA	BT6.6 BT5.23 BT6.65
15.10	CONTROL OF ROAD CONSTRUCTION, EXCAVATION, AND SIDE-CAST MATERIAL - To reduce sedimentation from unconsolidated excavated and side-cast material caused by road construction, reconstruction, or maintenance.	IDT has identified project location and mitigative measures in NEPA process. Protective measures will be kept current on all areas of disturbed, erosion-prone areas. TSA ensures contract compliance.	IDT; TSA	CT5.4
15.11	SERVICING AND REFUELING EQUIPMENT - To prevent contamination of waters from accidental spills of fuels, lubricants, bitumens, and other harmful materials.	ER/TSA/Contracting Officer will designate the location, size and use of service refueling areas. All projects will adhere to the KNF Hazardous Substance Spill Plan in case of accidents.	ER; TSA; Contracting Officer	CT6.221 BT6.34 CT6.34
15.12	CONTROL OF CONSTRUCTION IN RIPARIAN AREAS - To minimize the adverse effects on riparian areas from roads.	Except at designated stream crossings, road construction will avoid placing fill materials in riparian areas that will directly affect the ecological values of the stream.	ER; TSA	BT6.5 BT6.61 CT6.50
15.13	CONTROLLING IN-CHANNEL EXCAVATION - To minimize stream channel disturbances and related sediment production.	During construction of roads and installation of stream crossings, it may be necessary for construction equipment to cross or operate near riparian areas. This will be permitted by written agreement to minimize the effects to the stream and aquatic resources.	ER; TSA	BT6.5
15.14	DIVERSION OF FLOWS AROUND CONSTRUCTION SITES - To minimize downstream sedimentation by insuring all stream diversions are carefully planned.	The IDT has determined where stream crossings meet multiple resource objectives. Compliance with contract provisions would be done by the ER.	IDT; ER	BT6.5 CT6.3 CT6.51 CT6.52 CT6.6
15.15	STREAM CROSSINGS ON TEMPORARY ROADS - To keep temporary roads from unduly damaging streams, disturbing channels, or obstructing fish passage.	Temporary road will require the same mitigations as for specified roads to minimize the effects to the stream and aquatic resources.	IDT; TSA	BT5.1
15.16	BRIDGE AND CULVERT INSTALLATION - To minimize sedimentation and turbidity resulting from excavation for in-channel structures.	IDT has identified project location and mitigative measures in NEPA process. Protective measures will be kept current on all areas of disturbed, erosion-prone areas. TSA ensures contract compliance.	IDT; TSA	CT6.5
15.17	REGULATION OF BORROW PITS, GRAVEL SOURCES, AND QUARRIES - To minimize sediment production from borrow pits, gravel sources, and quarries, and limit channel disturbance in those gravel sources suitable for development in floodplains.	Where possible, soil should be removed and stockpiled for use as surface dressing during reclamation phases, prior to excavation of site.	ER	FS 611

SWCP	SWCP OBJECTIVE	CONSIDERATIONS FOR BEST MANAGEMENT PRACTICES	PERSON(S) RESPONSIBLE	CONTRACT PROVISION
15.18	DISPOSAL OF RIGHT-OF-WAY AND ROADSIDE DEBRIS - To insure debris generated during road construction is kept out of streams and prevent slash and debris from subsequently obstructing channels.	Ensure that materials do not obstruct natural drainage. Debris barriers from roadway clearing will be placed immediately below fillslope to slow the velocity of the surface runoff, and catching deposits of the runoff.	ER	FS 201
15.19	STREAM BANK PROTECTION - To minimize sediment production from stream banks and structural abutments in natural waterways.	IDT has identified project location and mitigative measures in NEPA process. Protective measures will be kept current on all areas of disturbed, erosion-prone areas. TSA ensures contract compliance.	IDT, ER	BT6.5
15.21	MAINTENANCE OF ROADS - To maintain all roads in a manner which provides for soil and water protection by minimizing rutting, failures, side-cast, and blocking of drainage facilities.	Road maintenance associated with a timber sale is the responsibility of purchaser. The ER/SA will ensure the purchaser maintains roads according to the appropriate maintenance level.	ER, SA	BT5.12 BT5.4 BT6.6 CT6.6 CT5.9 CT5.42 CT6.3
15.22	ROAD SURFACE TREATMENT TO PREVENT LOSS OF MATERIALS - To minimize the erosion of road surface materials and, consequently, reduce the likelihood of sediment production.	Protective measures will be kept current on all areas of disturbed, erosion-prone areas. ER ensures contract compliance.	IDT, ER	CT5.4
15.23	TRAFFIC CONTROL DURING WET PERIODS - To reduce the potential for road surface disturbance during wet weather and reduce sedimentation.	Road restrictions and traffic control measures will be implemented on all roads when damage would occur during spring breakup. The decision to restrict a road is made by the ER. Hauling restrictions would be controlled by the TSA.	ER, TSA	BT6.6 CT6.6 CT5.46 CT5.51 CT6.602
15.24	SNOW REMOVAL CONTROLS - To minimize the impact of snow melt on road surfaces and embankments and reduce the probability of sediment production resulting from snow removal operations.	Snow removal will be kept current on all roads associated with winter logging operations. The TSA ensures compliance with contract provisions.	IDT, TSA	CT5.46
15.25	OBLITERATION OF TEMPORARY ROADS - To reduce sediment generated from temporary roads by obliterating them at the completion of their intended use.	This work will be done on all new temporary roads in the decision area. The work will be done by the purchaser with compliance by the TSA.	TSA	BT6.62 CT6.6 CT6.603 CT6.623
18.03	PROTECTION OF SOIL AND WATER FROM PRESCRIBED BURNING EFFECTS - To maintain soil productivity, minimize erosion, and prevent ash, sediment, nutrients, and debris from entering surface water.	Prescribed burn plans identify the conditions necessary to prevent soil damage and meet site preparation objectives.	Fuels Specialist	Burn Plan

D-3 MONITORING

The objective of monitoring is to determine if land management activities are being implemented correctly and if they are effective. The following Monitoring Plans have been prepared for this project. They represent monitoring supplemental to other monitoring conducted by the Forest.

BMP MONITORING PLAN - Part 1

OBJECTIVE: To protect beneficial uses; to specify the BMPs to be incorporated into the Timber Sale Contract on a unit by unit basis, to document what BMPs were implemented to meet a specific SWCP and where they were applied, and provide an explanation of how the specific BMP was applied.

ITEMS TO MONITOR: BMPs as identified in project design features (Appendix D) that are applicable to each timber sale.

TYPE OF MONITORING: Implementation and effectiveness.

METHODS/PARAMETERS:

Before the timber sale contract is completed, the Pre-Sale forester review the contract the IDT. The review will focus on any concerns with unit layout and a consistency check between the contract and the NEPA document. The consistency check will include a review of whether or not contract provisions have been included into the contract.

The SWCP objectives applicable to each unit in a timber sale (BMPs) will be listed in the BMPs. BMP reporting will be reported on timber sale inspection forms and kept in the official timber sale file by the TSA or COR. If the TSA or COR finds that BMPs are not being implemented or that the SWCP objectives listed for that activity are not being met, it is their responsibility to see that corrective measures are taken to insure that all SWCP objectives will be met by the BMPs. If a unit has been identified by the IDT as being at risk for direct effect on water quality, the TSA or COR will schedule an Implementation and Effectiveness review with the district watershed specialist before that activity is completed.

FREQUENCY/DURATION: Start Date: Beginning of Project.
Completion Date: Final close-out of all sales identified in the South Manti decision area.

REPORTING PROCEDURES: Timber Sale Administrators and CORs will report all BMP on all timber sales resulting from this decision. Implementation documentation of BMPs are completed and forwarded to the Forest Hydrologist by December 31st each year until completion of sale.

PROJECTED COSTS: Workforce: Timber Sale Administrator/COR, Forest Hydrologist, District Watershed Specialist
Capital Costs: \$2,000/sale/year.

MONITORING RESPONSIBILITY: The District Ranger is responsible for monitoring. The IDT is responsible for completing BMP reporting. Timber Sale Administer and COR are responsible for the timely completion of the BMP reporting.

BMP MONITORING PLAN - Part 2

OBJECTIVE:

To document that Soil and Water Conservation Practice (SWCP) objectives were included in the Timber Sale Contract and implemented, to determine if BMPs were appropriate to meet SWCP objectives, and to visually determine if the BMPs were effective (successful) in meeting the objective of the appropriate SWCP and protecting beneficial uses.

ITEM TO MONITOR: BMPs

TYPE OF MONITORING: Implementation and effectiveness

METHODS/PARAMETERS:

BMP Implementation and Effectiveness Reviews will be conducted on 100% of all units/roads with special watershed concerns within this decision by the District Watershed Specialist and Sale Administrator. Unit acceptance will ensure that if SWCP objectives are not being met, corrective measures can be made before sale closure.

Review will occur yearly on at least 10% of all units/roads without special watershed concerns within active or completed sales associated with this decision by IDT.

Criteria for selection of the sites to be monitored will include proximity to larger ephemeral or perennial streams or other factors that could cause a concern for soil/water values. The District Watershed Specialist and District Ranger will determine which units/roads will be in each year's evaluation.

Monitoring the qualitative effectiveness of BMPs is accomplished by an IDT selected by the District Ranger. IDT membership will normally include a Hydrologist and/or Soil Scientist and an Engineer but may include Foresters, Wildlife or Fisheries Biologists, or other resources as needed.

Actual Review is accomplished by effectiveness of each identified practice as measured through ocular observation. The BMP is evaluated as it is reflected on the ground, and the observations are compared to the SWCP objective for that BMP. The effectiveness score will be the consensus opinion of the IDT.

FREQUENCY/DURATION: Start Date: Sale award
Completion Date: Timber sale closeout and acceptance at sale closure.

PROJECTED COSTS: Workforce: District IDT, Line and/or Staff Officers, SO/District Watershed Specialists.
Total Costs: \$2,500/year.

REPORTING PROCEDURES: Final to be completed by December 31st of the year of review.

MONITORING RESPONSIBILITY: The District Ranger is responsible for the Monitoring. Timber Sale Administer and COR are responsible for the timely completion of the BMP reporting. Forest Hydrologist/District Watershed specialists to assist with analysis and reporting.

VEGETATION MONITORING PLAN - STAND STRUCTURE, TREATED AREAS

OBJECTIVE: To monitor stand structure to determine if the alternative implemented met projections stated in the document for stocking, beetle risk, vegetative structural stage distribution, old growth, snags, and down woody material. Includes field review and analysis of post-sale and stocking surveys.

ITEM TO MONITOR: Vegetation structure on treated stands.

TYPE OF MONITORING: Implementation and effectiveness.

METHODS/PARAMETERS: Current stand exam requirements.

FREQUENCY/DURATION: After follow-up activities are complete (within 5 years).

PROJECTED COSTS: 2 people for 8 days at \$200/day = \$1,600.

REPORTING PROCEDURES: District stand exam files.

RESPONSIBILITY: District Silviculturist, District Wildlife Biologist.

VEGETATION MONITORING PLAN - REFORESTATION, PLANTED AREAS

OBJECTIVE: To monitor planted areas to assure meeting survival requirements for first and third years and stocking certification requirements in Silvicultural Prescription within 3 years. This includes monitoring for damage to seedlings caused by livestock, wildlife, or other causes.

ITEM TO MONITOR: Planted areas.

TYPE OF MONITORING: Implementation and effectiveness.

METHODS/PARAMETERS: Field review before sale contract is complete to assure adequate slash cleanup and site preparation. Post-contract field review of survival and stocking.

FREQUENCY/DURATION: 1 day before timber sale contract completion and in 1st and 3rd years after planting.

PROJECTED COSTS: Survival Exam \$3.50/acre planted.
Stocking Exam \$4.50/acre harvested and planted.
Plantation Monitoring \$9,000/year.

REPORTING PROCEDURES: R4 RMRIS reporting forms.

RESPONSIBILITY: District Ranger, District Silviculturist.

VEGETATION MONITORING PLAN - REFORESTATION, NATURAL

OBJECTIVE: To assure natural regeneration areas are meeting stocking certification requirements in Silvicultural Prescription within 5 years. This includes monitoring for damage to seedlings caused by livestock, wildlife, or other causes.

ITEM TO MONITOR: Areas identified for natural regeneration.

TYPE OF MONITORING: Implementation and effectiveness.

METHODS/PARAMETERS: Field review before sale contract is complete to assure adequate slash cleanup and site preparation. Post-contract field review of stocking.

FREQUENCY/DURATION: Review 1 day before timber sale contract completion and in 3rd or 5th year after harvest.

PROJECTED COSTS: \$4.50/acre harvested and prescribed for natural regeneration.

REPORTING PROCEDURES: R4 RMRIS reporting forms.

RESPONSIBILITY: District Ranger, District Silviculturist.

NOXIOUS WEEDS MONITORING PLAN

OBJECTIVE: To detect changes in noxious weed populations along Forest Development Roads leading to the timber sale area and within harvest units; and to assure the inclusion, implementation, and effectiveness of : Special Provision CT6.26# - Noxious Weed Control. Requiring Timber Purchasers to furnish proof of weed-free equipment.

ITEM TO MONITOR: Changes in noxious weed populations along Forest Development Roads leading to the timber sale area and within harvest units.

TYPE OF MONITORING: Implementation and effectiveness.

METHODS/PARAMETERS: Visual observations at known inventoried locations within sale area and roads leading to sale.

FREQUENCY/DURATION: Start Date: Beginning of sale.
Completion Date: One year after completion of sale.

PROJECTED COSTS: Workforce: Two-person noxious weed crew. District Range Conservationist.
Total Costs: \$500/sale/year.

REPORTING PROCEDURES: District Range Conservationist will write annual report documenting monitoring by December 31st of each year.

RESPONSIBILITY: District Ranger, District Range Conservationist, Sale Administrator.

CULTURAL RESOURCES MONITORING PLAN

OBJECTIVE: To protect significant, Historical, and Paleontological Resources from effects of actions alternatives.

ITEM TO MONITOR: Monitor known sites to prevent damage from action alternatives.

TYPE OF MONITORING: Implementation and effectiveness.

METHODS/PARAMETERS: Field review by Sale Administrator during the life of the sale.

FREQUENCY/DURATION: As necessary during the life of the sale.

PROJECTED COSTS: No monitoring-specific costs will be incurred additional to routine sale administration.

REPORTING PROCEDURES: Timber Sale Inspection Report. Copy of applicable reports to be filed with Archaeologist.

RESPONSIBILITY: District Ranger, Contracting Officer, Sale Administrator.

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APPENDIX E

UNIT INFORMATION

APPENDIX E - SUMMARY UNIT INFORMATION

Forest Health, Diversity, and Productivity Alternative, Analysis Rationale, and Economic Analysis Information

The Forest Health, Diversity, and Productivity Issue analysis and alternative recommendations for this Environmental Impact Statement were completed utilizing the information developed for the South Manti Salvage Timber Sales Environmental Assessment (1996). Extensive information was developed for that document utilizing silviculture inventory data (RMSTAND program) and Forest Vegetation Simulator (FVS) model runs. This information provided the basis for the alternative evaluations and outputs which are presented in the current document. Alternatives 1 and 2 from the 1996 document evaluated the effects of full expansion of the spruce beetle outbreak throughout the project area, therefore, these alternatives with Alternative 3 (maximum treatment area proposed in 1996) provided the basic mortality and reforestation need information utilized to project alternative outputs for the current analysis. No site-specific information was available for Units G5 (134 acres) and G6 (139 acres) which were not evaluated in the original document, but have been added to this proposal. Estimates for these units were made by comparison of the percentage of units treated for planting, natural regeneration, site preparation for natural regeneration, fencing, and gopher control treatments. The documentation of the evaluation/computation of these figures is contained in a Quatro Pro spreadsheet in the project record.

The project proposal included the need to return Forest Plan TBR emphasis areas to a forested (stocked) condition in the shortest possible time-frame. Therefore, emphasis was placed on including TBR areas in the proposed salvage units in order to provide the opportunity to utilize timber from these sites and facilitate planting and natural regeneration treatments. Although the majority of the area is classified as RNG emphasis, no proposals were made for the type conversion of these stands to open meadow-like conditions. In fact, it was desirable for a variety of resource benefits to maintain or return as much of this type to spruce-fir or aspen forest as well, and as a result RNG units were included in the proposals for reforestation (planting and natural) treatments. This is supported by National and Forest Plan direction.

Given the fact that a portion of the area from the original project proposal has been treated and some area dropped from the proposal, total reforestation and protection needs for the current analysis were computed based on the percentage of the acreage in this proposal from the original. The proportion of the original planting, natural regeneration, site preparation for natural regeneration, gopher control treatments, and fencing were computed in total on a proportionate basis to the acres treated and not on a unit by unit basis. The following information describes the rationale for computation of these figures based on the 1996 analysis.

Reforestation Needs: Planting and natural regeneration acreages were calculated for the 1996 document by comparison of estimates of stockability and plantability made by Glen Jackson, Don Okerland, and Greg Montgomery based on aerial photo interpretation and knowledge of the proposed treatment units. Inventory and FVS modeling was utilized (Montgomery) to make estimates of the area adequately stocked (at the time of analysis and following mortality projections) to project reforestation needs, which were then identified for planting or natural regeneration. Machine scarification or site preparation for natural regeneration (SPN) treatments were projected based on the percentage of the tractor loggable ground in the total treatment area less than 20 percent slope (GIS computation).

Protection Needs: The need for protection of reforestation investments and to assure an adequate level of restocking to recover the treated sites affected by the spruce beetle outbreak was anticipated. Due to the extent of pocket gopher activity noted on field review of the area, past planting failures that appeared to be caused in part by damage from gophers, and experience from similar sites and conditions on other forests, gopher control treatments utilizing strychnine treated oats in below ground (burrow/tunnel) treatments were planned within and on the fringe of planted areas (an area > 100 feet from the edge of the plantation). The planting acreages were adjusted upward by 0.1 acres per acre planted to compute the acres receiving gopher treatments.

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The need for some fencing was anticipated to deter permitted livestock (primarily cattle) from causing extensive damage to accessible plantation areas with slopes less than 25%. Roughly 30-40% of the proposed treatment units were computed to be Slope Class 1 (0-20%). Not all of the Slope Class 1 areas would require fencing and potentially a few areas over 20% could be fenced for ease of management. Because more precise or site-specific information was not available, a direct relationship was assumed between the Slope Class 1 acres and plantable area requiring fencing and 30% of the planted area was estimated to require this treatment. The computed acreage was adjusted by an edge/perimeter factor of .032 miles per acre to estimate miles of fencing required for the economic analysis.

A plantation monitor (short-term or seasonal employee) was included in the economic analysis in order to anticipate the need for an individual to maintain plantation fences, provide for monitoring of grazing in order to identify areas where grazing conflicts develop prior to loss of the plantation, and provide information on sensitive areas to herders and/or permittees. This individual would assist the Silviculturist and Range Vegetation Specialist in their management of these areas in order to minimize conflicts and provide the quickest possible recovery of treated sites.

Cost of these treatments for economic evaluation were based on the most current information available from forest projects or were developed using regional average or other forest's costs to provide a basis of comparison for this analysis. The economic analysis was completed utilizing the INVEST V economic analysis program (USDA Forest Service, 1994). Two runs were completed to compare alternatives for the current analysis. The first run included the costs and benefits of the salvage sales (stumpage value, preparation costs, road cost, reforestation and protection costs, and etc.). Since this project is the result of a catastrophic event and reforestation costs are not required to be applied to the cost of the salvage sale, the second run excluded the reforestation costs in order to display the difference between the cost of planning, preparing, and implementing the salvage and the cost of rehabilitating treated areas.

The attached tables display of the proposed treatments. The tables provide information relative to the designated logging system and Forest Plan prescription emphasis by unit for each alternative. Also included are the total reforestation and protection needs that were included in the environmental impact statement. Map displays of the Alternatives including unit identification, are contained in Chapter 2 of the environmental impact statement. The attached Harvest Plan also provides supplemental information about how the proposed harvest would occur if selected for implementation.

15/ Greg Montgomery
GREG T. MONTGOMERY
Silviculturist

TABLES

Figure E-1 REFORESTATION AND PROTECTION NEEDS

ALTERNATIVE	Treatment	Reforestation Acres			Protection	
	PLANT Acres	PLANT Acres	NATURAL Acres	SCARIFY Acres	GOPHER Acres	FENCE Miles
2	6530	1133	1888	876	1246	11
3	6530	1133	1888	876	1246	11
4	3975	697	1160	539	766	7

Figure E-2 LOGGING SYSTEM AND FOREST PLAN EMPHASIS, ALTERNATIVE 2

UNIT #	UNIT Acres	Harvest System Acres				Forest Plan Prescription Acres			
		TRACTOR	HELI	CABLE	HELICOPTER	TBR	RNG	DRS	WPE
A-1	40				40		40		
A-3	39			39			39		
A-5	29				29		29		
A-7/8	107				107	99	9		
A-9	94				94		94		
A-11	16	16					16		
B-4	29	29					29		
C-1/2	115				115	105	10		
C-3	29				29		29		
C-4	124				124	111	13		
C-6	18				18		18		
C-7	36				36		36		
C-8	16				16		16		
D-1	42*	174			247		421		
D-2	212	30			182		212		
D-3	543	194			349	62	481		
D-4/5	874	293			580	259	814		
E-1	262	94			168		262		
E-2	326	31			295		301	25	
E-3	1043	252			791	719	324		
E-4	29				29		29		
F-1	572	151	76		345	275	297		
F-3	415	32			383	148	267		
G-1	368	39			329	316	32		
G-2	37				37	3	34		
G-3	244				244		242		2
G-4	191	141			47		191		
G-5	134				134	50	94		
G-6	139	139					139		
TOTAL	8530	1618	115		4796	2147	4365	25	2

Figure E-3 LOGGING SYSTEM AND FOREST PLAN EMPHASIS, ALTERNATIVE 3

UNIT #	UNIT	Harvest System Acres			Forest Plan Prescription Acres			
		TRACTOR	HELI/CABLE	HELICOPTER	TBR	RNG	DRS	WPE
A-1	40			40		40		
A-3	39		39			39		
A-6	29			29		29		
A-7/8	107			107	99	8		
A-9	64			64		64		
A-11	16	16				16		
B-4	29			29		29		
C-1/2	115			115	105	10		
C-3	28			28		28		
C-4	124			124	111	13		
C-6	18			18		18		
C-7	36			36		36		
C-8	16			16		16		
D-1	421			247		421		
D-2	212			182		212		
D-3	543			349	62	481		
D-4/5	874			716	260	614		
E-1	262			262		262		
E-2	326	31		295		301	25	
E-3	1043			1043	719	324		
E-4	28			28		28		
F-1	572	151	76	345	275	297		
F-3	415	32		383	148	267		
G-1	368			368	316	52		
G-2	97			97	3	94		
G-3	244			244		242		2
G-4	191	144		47		191		
G-5	134			134	50	84		
G-6	139			139		139		
TOTAL	6530	1069	115	5346	2148	4355	25	2

Figure E-4 LOGGING SYSTEM AND FOREST PLAN EMPHASIS, ALTERNATIVE 4

UNIT #	UNIT	Harvest System Acres			Forest Plan Prescription Acres			
		TRACTOR	HELI - CABLE	HELICOPTER	TBR	RNG	DRS	WPE
A-1	40			40		40		
A-3	39		39			39		
A-6	29			29		29		
A-7/8	107			107	99	8		
A-9	64			64		64		
A-11	16	16				16		
B-4								
C-1/2	115			115	105	10		
C-3	28			28		28		
C-4	124			124	111	13		
C-6	18			18		18		
C-7	36			36		36		
C-8	16			16		16		
D-1	421			247		421		
D-2	212			182		212		
D-3	543			349	62	481		
D-4/5	874			716	260	614		
E-1	262			262		262		
E-2	326	31		295		301	25	
E-3	1043			1043	719	324		
E-4	28			28		28		
F-1	572	151	76	345	275	297		
F-3	415	32		383	148	267		
G-1								
G-2								
G-3	244			244		242		2
G-4	191	144		47		191		
G-5	134			134	50	84		
G-6	139			139		139		
TOTAL	3975	1069	115	2791	949	2999	25	2

HARVEST PLAN

The following are the recommended harvest methods and equipment needed to meet the direction developed for South Manti.

On slopes less than 40% the following equipment can be used: wheel skidders, tractor (cat), feller/buncher, and forwarder. The recommended distance between skid trails is 75 to 100 feet. Grapple skidding is allowed for both wheel skidders and tractors. However to meet resource objectives a tractor or wheel skidder equipped with a winch capable of pulling line 100 feet may be required. Directional falling and line pulling of logs will be required to protect resources and improvements found in the project area. These resources or improvements will be identified in the logging plan or sale area map.

All landing, skid trails, skid roads, and work roads will be identified or approved in advance by the designated official. Landings for tractor logging should not exceed 1/2 acre in size. Skid trails are formed by multiple passes to a landing over the same trail. Skid roads are constructed trails in which logs are skidded to a landing. Work roads are contractor constructed roads or temporary roads less than 2 tenths of a mile. It is recommended that skidding and hauling take place when soils in the sale area are dry or frozen.

On slopes greater than 40%, or where access or resources dictate other harvest methods helicopter or cable yarding methods will be used. Cable yarding has been identified where existing or temporary roads exist or are planned and for distances over 300 feet the slope profile allows partial suspension of logs. However, in the ground-based units, the timber operator may optionally elect to use less impactful cable yarding. Helicopter yarding will be used in all other areas where tractor or cable harvest is not possible.

The recommended cable yarding equipment is the following: for distances less than 100 feet a cat equipped with a winch; for yarding distances less than 300 feet a shovel loader with tongs; for yarding distances over 300 feet and under 1,000 feet a live skyline with a mechanical carriage. Landings and skyline corridors are recommended to be 150 feet apart with skyline corridors to be a maximum of 15 feet wide and landings no more than 1/4 acre in size.

The minimum requirements for helicopter yarding is a 3,000 to 4,000 pound average payload and a machine that is effective at 10,000 feet elevation. The one helicopter in this area that meets the minimum requirements is the K-Max. Helicopter landing sites have been identified in the South Manti document. The size of helicopter landings should be less than 2 acres. There could be up to 30 helicopter landings and 4 service landings. There is little need for constructing any helicopter pads to ferry workers to the harvest sites. Most harvest sites are within 3,000 feet of the helicopter landing sites. Many open ridge tops are available to land a helicopter without the need of felling trees or leveling a landing site.

When an operating plan has been submitted to harvest timber the sale administrator will contact resources specialists to identify any resources that require protection. The harvesting of timber by tractor, cable and helicopter will follow all contract provisions and other requirements found in the environmental document. The timber sale layout and contract will be reviewed by an interdisciplinary team or other appropriate resource specialist during sale and contract preparation.

Harvest Description By Alternative

A1 Helicopter/Alt 2, 3, 4: Helicopter yard to an existing tractor landing (Olga TS) located off of South Skyline Drive. The average down hill yarding distance is 1,848 feet to the landing.

A3 Cable- Helicopter/Alt 2, 3, 4: Cable yard to Skyline Drive, recommended to use live skyline with mechanical carriage. The approximate yarding distance is 858 feet. Due to the limited number and location of adequate guy line trees, some yarding across the slope will be necessary. If helicopter harvest is elected, use existing landing located off the Muddy Road; the approximate down hill yarding distance is 1,452 feet.

A6 Helicopter/Alt 2, 3, 4: Yard to two landings one located off South Skyline Drive the second located off Muddy Road, both landings would require construction. Approximate down hill yarding distances are 792 and 1,056 feet.

A7, 8 Helicopter/Alt 2, 3, 4: Yard to a landing located on a temporary road used for the Duck Timber Sale; approximate down hill yarding distance is 2,178 feet.

A9 Helicopter/Alt 2, 3, 4: Landing located off existing reconstructed user-developed road. The road would have an adverse haul and may require tractor assistance. The average yarding distances is 2,310 feet; the yarding will be side hill and adverse.

B4 Tractor/Alt 2: Tractor yard to existing road constructed for the Baldy Timber Sale and yard to existing landings, approximate yarding distance is 1,188 feet.

B4 Helicopter/Alt 3: Helicopter yard to same landing as in Alternative 2 for approximately 1,188 feet, yarding will be side hill and adverse.

C3 Helicopter/Alt 2, 3, 4: Helicopter yard to same landing used for A9, approximate yarding distance is 4,000 feet. The landing is the same elevation as the unit.

C1, 2 Helicopter/Alt 2, 3, 4: Helicopter yard down hill to a landing to be constructed off of Muddy Road; approximate yarding distance is 3,300 feet.

C4 Helicopter/Alt 2, 3, 4: Helicopter yard to a landing located on a ridge approximately 200 feet off the Blue Lake Road; approximate yarding distance is 3,200 feet down hill. An alternate landing site is located just off of the breached Henningson Reservoir; approximate down hill yarding distance is 2,224 feet.

C6 Helicopter/Alt 2, 3, 4: Helicopter yard to a landing to be constructed; the average yarding distance is 1,254 feet and approximately half the volume will be yarded adversely.

C7 Helicopter/Alt 2, 3, 4: Helicopter yard down hill to landing located just off the breached Henningson Reservoir; approximate yarding distance is 1,980 feet.

C8 Helicopter/Alt 2, 3, 4: Yard to same landing used for C7, approximate distance is 1,254 feet up hill. This volume could also be tractor yarded using existing roads that will be reclaimed. The road is too steep to allow hauling by truck; the landing would be located adjacent to the Blue Lake Road.

D1 Tractor/Alt 2, 3, 4: Yard to a temporary road; approximate yarding distance is 594 feet with 5 landings.

D1 Helicopter/Alt 2, 3, 4: Helicopter yard to one of the landings located within the tractor unit. The up hill yarding distance is approximately 2,376 feet. An alternate landing location is located adjacent to the Blue Lake Road; the approximate down hill yarding distance is 5,214 feet. The Original plan was to construct a short spur road into the landing; a site visit found that it was not possible to construct a road due to water concerns.

D2 Tractor/Alt 2, 3, 4: From the unit, yard logs down the existing road/trail to a landing on the reconstructed road located in D3; approximate yarding distance is 3,036 feet. This would require a temporary crossing of Mill Creek, in the same location as the existing road crossing. This crossing would be removed after harvest.

D2 Helicopter/Alt 2, 3, 4: This unit is scattered with many wet areas and streams. Downhill yarding to landing planned for D3; approximate distance is 3,498 feet.

D3 Tractor/Alt 2, 3, 4: Plans for construction of a work road for approximately 1,320 feet and use of reconstructed Mill Creek Road. There will be long skids to access the timber with open ground between the road and the marked units; it will require approximately 6 landings to harvest the units.

D3 Helicopter/Alt 2, 3, 4: Plan to yard to two landings one located on the work road off of reconstructed road in Mill Creek, yarding distance is approximately 2,310 feet down hill. The other landing is located adjacent to the Baseball Flat Road; approximate yarding distance is 2,640 feet.

D4&5 Tractor/Alt 2: The upper road to be constructed is located off Baseball Flat Road and is located outside of the roadless boundary. It is planned to skid the units located inside and outside the roadless boundary to this road. Average yarding distance is approximately 1,122 feet to eight landings.

The middle road to be constructed is located off Black Fork Road and is located outside of the roadless boundary. It is planned to skid the units located inside and outside of the roadless boundary to this road. Average yarding distance is approximately 1,188 feet to three landings.

The lower road to be constructed is also located off Black Fork Road and is located outside of the roadless boundary. It is planned to skid the units located inside and outside of the roadless boundary to this road. Average yarding distance is approximately 660 feet to three landings.

D4&5 Helicopter/Alt 2, 3: The remaining units inside and outside of the roadless areas will be helicopter harvested to landings located outside of the roadless area boundary. There are three landings, located on one of the constructed roads. The upper landing has a adverse yarding distance of 1,518 feet, the middle landing has a down hill yarding distance of 2,574 feet, the lower landing has a down hill yarding distance of 3,300 feet.

D4&5 Tractor/Alt 4: Tractor harvest would only take place in the roaded portion. Logs would be yarded to 10 landings on constructed and temporary roads; yarding distances would be halved.

D4&5 Helicopter/Alt 4: Helicopter harvest would only take place in the roaded portion and the logs yarded to two landings located on constructed roads; yarding distance would be approximately 1,287 and 1,650 feet down hill to the landings.

E1 Tractor/Alt 2: Would reconstruct a portion of the existing road and construct a temporary road for approximately 1,452 feet off of the existing road to access portion of unit that is outside of the roadless boundary. Plan to yard the one area outside of the roadless boundary and tractor ground within the roadless boundary to both roads. Yarding distance is approximately 1,782 feet to five landings.

E2 Tractor/Alt 2, 3, 4: Tractor harvest hazard trees in the summer home area using the existing roads; average skid distance is 528 feet to three landings. Directional falling and or lining of trees will be necessary to protect resources.

E1&2 Helicopter/Alt 3: Plan to yard all areas except around the summer homes by helicopter. Three landings have been identified; one on South Skyline Drive and two on the Ferron Road. The upper landing yards 1,452 feet up hill, the middle landing yards 3,828 feet down hill, and the lower landing yards 2,904 feet down hill.

E1&2 Helicopter/Alt 4: Only areas outside of the road less boundary would be harvested to two landings. The upper landing yards 1,452 feet up hill and the lower landing yards 1,584 feet down hill.

E3 Tractor/Alt 2: Plan to reconstruct the existing road and construct a road to access the lower portion of the tractor ground. Yarding would be to the constructed road. The yarding distance is approximately 792 feet.

E3 Helicopter/Alt 2: Plan to helicopter yard to two landings one located off existing road and one located on constructed road. The down hill yarding distance for each landing is approximately 4,092 feet.

E3 Helicopter/Alt 3: Plan to yard all of E3 to one landing located at the corrals on existing road; the down hill yarding distance for the one landing is approximately 6,600 feet.

E4 Helicopter/Alt 2, 3: Plan to yard all of E4 to the middle landing; the downhill yarding distance is approximately 2,376 feet.

F1 Tractor/Alt 2, 3, 4: In the tractor portion of F3, plan for reconstruction of existing road and construction of a temporary road for approximately 2 tenths of a mile to reduce skidding distances by half. This road also accesses a portion of the unit that could be cable harvested. Also plan for a 2 tenths of a mile work road off existing road to access the tractor ground and the rest of the cable ground. To harvest the timber there will be about 8 tractor landings and 10 cable landings needed. Tractor yarding distance is approximately 600 feet; cable yarding distances is approximately 800 feet.

F1 Helicopter/Alt 2, 3, 4: Yard the helicopter portion of F1 to two landings, one located off the existing road at the top of F1 and the second landing an existing landing from the Duck Timber Sale. The yarding distance for the upper landing is approximately 2,970 feet up hill; the yarding distance for the lower landing is 5,214 feet down hill.

F3 Tractor/Alt 2, 3, 4: Tractor yard to the reconstructed road; approximate yarding distance is 528 feet to 4 landings.

F3 Helicopter/Alt 2, 3, 4: Helicopter yard to a landing planned off the reconstructed road; the approximate yarding distance is down hill 3,234 feet. One alternate landing is planned; approximate yarding distance is 6,660 feet down hill.

G1, 2 - Helicopter/Alt 2, 3: Helicopter yard to two landings one or both landings constructed for the Baldy Timber Sale. Average down hill yarding distance to the first landing is 3,630 feet, and 2,970 feet to the second landing.

G1 - Tractor/Alt 2, 3: The unit is located within the road less area. Tractor yarding to existing landings constructed for the Six Timber Sale; reclaim road after use. Average skidding distance is 1,584 feet to 1 landing.

G3 - Helicopter/Alt 2, 3, 4: North unit, helicopter yard to existing landing. Average distance to the lower landing is 3,366 feet.

South unit, helicopter yard to landing located on the Six Mile road, the average down hill yarding distance is 1,980 feet.

G4 - Helicopter/Alt 2, 3, 4: Helicopter yard down hill to landing constructed for the Six Timber Sale that can be enlarged for helicopter; average distance to landing is 1,782 feet.

G4 - Tractor/Alt 2, 3, 4: There is both up hill and down hill skidding to the open road. Pulling of line will be necessary along sections of the perennial stream. Average skidding distance is 660 feet to 7 landings, and the slope averages 25%.

G5 - Helicopter/Alt 2, 3, 4: Helicopter yard to landings constructed for the Twelve Mile Timber Sale; average down hill yarding distance to the landings is 2,970 and 2,442 feet.

G6 - Tractor/Alt 2, 3, 4: Plan to skid logs to the Twelve Mile Road and Skyline Drive, use existing skid trails to avoid steep sections along the Twelve Mile road. The section located below the Twelve Mile road will require line yarding to the road, estimated yarding distance 300 feet. Average skidding distance is 726 feet to 8 landings, and the average slope is 25%.

ISI Steve Cote

Steve Cote

Pre - Sale Technician

APPENDIX F

ROAD INFORMATION

APPENDIX F - SUMMARY ROAD INFORMATION

The transportation needs vary in each action alternative (see Figures F-1, F-2, F-3 and F-4). All action alternatives would require reconstruction and temporary road construction, while only Alternative #2 would construct any Forest Development Roads (FDRs), approximately 1.1 mile (tentatively to be numbered as FDR 52362). All constructed roads, whether FDR or temporary would be closed to public use unless otherwise specifically authorized. All project-created temporary roads would be reclaimed after use in all of the action alternatives.

FDR Reconstruction

Where needed: replace culverts, place additional cover material over culverts, construct turnouts, improve sight distance by cutting trees, laying back cut banks, or reducing grades on vertical curves, and replacing material where the road template needs to be raised or reconstructed. Road condition surveys are required for 50044, 50070, 50285, 52290, and 52602.

All FDRs listed for reconstruction (50161, 50044, 50070, 50285, 52290, 52062, 50049, 50150, and 50333) would need reconstruction on part or all road segments.

Specific Reconstruction Needs

FDR 50161: Approximately 1 mile of raising the roadbed elevation 12" by importing material from Baseball Flat borrow pit, or by borrowing from adjacent cutbanks within the first mile of road. Approximately 0.5 miles of placing cushion material where the roadbed traverses bedrock, possibly from the same borrow areas, and reconstructing approximately 1 mile to accommodate log trucks. Survey and design is required on partial segments. A road log is required on the entire length (4.0 miles). There is opportunity to close out a user developed road segment that parallels FDR 50161 for approximately 1 mile. The alignment traverses a rocky ridge, the parallel facility drops off the rocky ridge and traverses a meadow, within approximately 500 feet. Both facilities are not necessary.

FDR 50333: Reconstruct approximately 0.7 miles to eliminate steep grades and sharp curves. This segment is beyond the junction with trail 003. A survey was completed in 1997; design to be completed in 1998 or early 1999. Also, a wider cattleguard is needed, or place a second cattleguard during haul (to make a double) and remove after haul to be placed elsewhere. There is opportunity to close out some user developed roads in the area, as well as reclaim the north half of the loop, as identified in 1995 when Rangers and specialists met to discuss transportation needs.

FDR 50044: Approximately 5.2 miles of road (or segments along this stretch) may receive 4.5" of aggregate, depending on resource concerns and the volume of timber to be removed. Previous decisions on aggregate placement have been based on 5 to 10 MMBF hauled over the road before aggregate placement becomes economical.

FDR 50049: For haul over Duck Fork Reservoir embankment, the Forest intends to place 12" of aggregate over the 1250' embankment as load distribution. The Forest Service does not plan to disturb the emergency spillway hydraulically. The alignment beyond the dam is unsuitable for haul trucks, and requires realignment for appropriate 0.7 miles of grades and adequate drainage crossings. Culverts crossing live water and for ditch relief need be designed. The construction activity falls under the "reconstruction" category because the alignment serves to access the same area. The Forest Service has the responsibility to reclaim the old alignment by ripping, seeding, signing and barricading the area. By closing out the old alignment, some user developed roads will no longer be accessible. If funds are available, these areas should be reclaimed. After harvest and hauling is complete, approximately 8" of aggregate from the embankment intends to be removed and placed on the Duck Fork road, between Ferron and Duck Fork Reservoirs.

FDR 50150: Additional turnouts are needed throughout the full bench section above Emerald Lake. Each intends to be standard length, 65', with 50' tapers. A disposal site for the excavated material needs to be determined. Also, a wider cattleguard is necessary south of Twelvemile Flat Campground.

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FDR 51270: A segment of user-developed road at the end of 51270 needs to be added to the system, the work anticipated is minor: blade and shape road to standard road template and place culvert.

FDR 52065: Curve widening, possible addition of aggregate to the intersection of 52065 and 50022, and installation of a culvert, if necessary.

FDR 52290: A short realignment may be necessary to reduce grade and make the area accessible by log truck. The construction activity falls under the "reconstruction" category because the alignment serves to access the same area.

Forest Trail #003: Approximately 0.2 miles of this trail needs to be reconstructed to accommodate log trucks. This includes wider travelways and drainage. After harvest activity is complete, trail width intends to be re-established.

Forest Trail #007: Approximately 0.3 miles of this trail needs to be reconstructed to accommodate log trucks. This includes wider travelways and drainage. After harvest activity is complete, trail width intends to be re-established.

New Construction Temporary and System

Inventory numbers have been assigned to the new construction road segments that would be added to the Forest Road System. Temporary roads are listed by the unit they access. Below is a list showing these segments by road number, length, Road Management Objective (RMO), and construction remarks.

Inventory #	Length	RMO	Remarks
D3/4#1	1.0 mi	temporary access	Starts at southern end of Baseball Flat Road, switchback required, with approach full bench section. Pipe required at junction with D3/4#2.
D3/4#2	1.1 mi	temporary access	Starts at end of D3/4#1 and trends southeast, then switchbacks to the northwest. Avoid spring areas beyond switchback.
D3/4#3	1.1 mi	temporary access	Starts at junction of D3/4#1 and D3/4#2 and trends northwest to switchback #1, then east to switch back #2, then westerly again.
D2/3#1	1.0 mi	temporary access	Starts off FDR 50333. Culverts necessary for stream crossings.
D3/4#4	0.2 mi	temporary access	Starts at switchback #1 on D3/4#3 and trends northwest.
D5#1	1.0 mi	temporary access	Starts off trail #003, and crosses live water. Culvert design required.
F1#1	0.3 mi	temporary access	Start off 52602, trends east and southeast.
F3#1			
D5#2	0.9 mi	temporary access	Starts off trail #003. This alignment will be reclaimed at the end of harvest activity. Avoid the unstable ground.
52362*	1.1 mi	Long term, intermittent use. Level 1 maintenance.	Starts off FDR 50285, trending southwest. Opportunity to close out the section of 50285 that runs adjacent to Little Horse Creek.
D1#1	0.8 mi	temporary access	Starts off FDR 50161, trending east. Temporary crossing (culvert) intermittent drainage. Trackhoe type excavation work through rock bench. Some blasting expected.
D1#2	0.6 mi	temporary access	Starts off FDR 50169. Culverts necessary for stream crossings.

* tentative road numbering

Summary of Construction and Reconstruction

Unit	New Construction Temporary Work Road	New Construction System Road	Reconstruction	Road Management
A5/A9	0.2 mi			TS Operator reclaim
D1	0.2 mi (for heli)			TS Operator reclaim
D1	0.8 mi			TS Collection, FS reclaim.
D1			1.2 (50161)	LC, ML2, TSL-D
D2/D3			1.6 (50333)	LC, ML2, TSL-D
D3/D4	1.0 mi			TS Collection, FS reclaim
	1.1 mi			TS Operator reclaim
	1.1 mi			TS Operator reclaim
	0.2 mi			TS Operator reclaim
D3/D4			2.8 (50161)	LC, ML2, TSL-D
D5	1.0 mi			TS Operator reclaim
	0.9 mi			TS Operator reclaim
D5			1.6 (50333)	LC, ML2, TSL-D
E1	0.2 mi			TS Operator reclaim
E1			0.3 (52290)	LC, ML2, TSL-D
E3			0.5 (50070)*	LC, ML2, TSL-D
E3			0.3 (50285)*	LC, ML2, TSL-D
E3		1.1 mi		LI, ML1
F1/F2	0.3 mi			TS Operator reclaim
F1/F2			0.4 (52602)*	FS reclaim last 0.5 miles+
G4			0.2 (51270)	LC, ML2, TSL-D

* Environmental document categorizes work as maintenance. TS operator will perform maintenance under CT 5.411.

FS = Forest Service

TS = Timber Sale

LC = Long term road, Constant use

LI = Long term road, Intermittent use

ML1 = Maintenance Level 1 = System Road, closed to public use.

ML2 = Maintenance Level 2 = System Road, maintained for high clearance vehicles, seasonal use.

TSL = Traffic Service Level

System Road Reclamation

The following are Forest Development Roads not used as haul routes, but identified for reclamation when funding becomes available (see Figure F-4 Proposed Road Closure and Reclamation for locations).

50285: Roaded access to the weather station and corral is needed and would remain on the system. Beyond the corral (approximately 1.4 miles) this road is not needed for management of Forest resources. Additionally, its proximity with Little Horse Creek and multiple unprotected stream crossings is undesirable for water quality.

50333: The proposed obliteration would start at Link Canyon Road (50044) across Slide Fork Creek to "Dewey Jensen" tree, a local marker. This is the north half of the loop. The south half would remain a system road, open seasonally to public use. The western reach of this loop road crosses Slide Fork Creek without protection considerations for the stream, and damage is evident. Other damage is occurring in this same area due to ATV and 4x4 vehicles creating unapproved trails for recreational purposes.

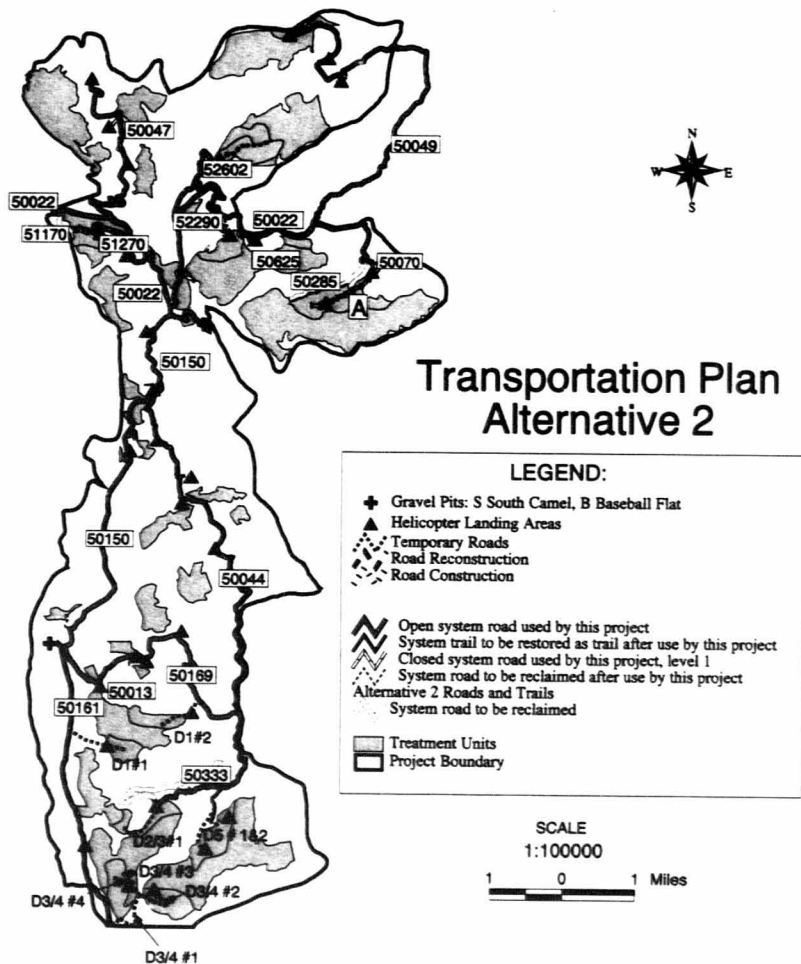
Nonsystem Road Reclamation

All nonsystem roads have been identified for reclamation as funding becomes available (see figure F-4 Proposed Road Closures and Reclamation). After harvest activity and at the completion of post sale activity, those roads listed for reclamation would be obliterated as follows:

1. Scarify road template to a depth of :
 - non-timbered areas, 6".
 - timbered areas, 12"-18", where soils allow.
2. Revegetate disturbed areas with appropriate seed mixes or seedlings.
3. Remove drainage structures, reshape the drainage channel as directed by the Forest Hydrologist.
4. Final road decommissioning will incorporate one or more of the following, as directed by an interdisciplinary team:
 - installing earth, rock, log barrier at entrance
 - installing buck and pole fence at entrance, possibly more than one installation
 - installing gate
 - recontouring for fixed distance, based on geography, landscape, visuals, etc.
 - scattering of large-woody debris over entire road
 - signs (e.g. "Road decommissioned for resource protection, Please do not travel beyond this sign.")
5. Construct water bars on slopes 5% or greater.

Prepared by: Martha DeFreest

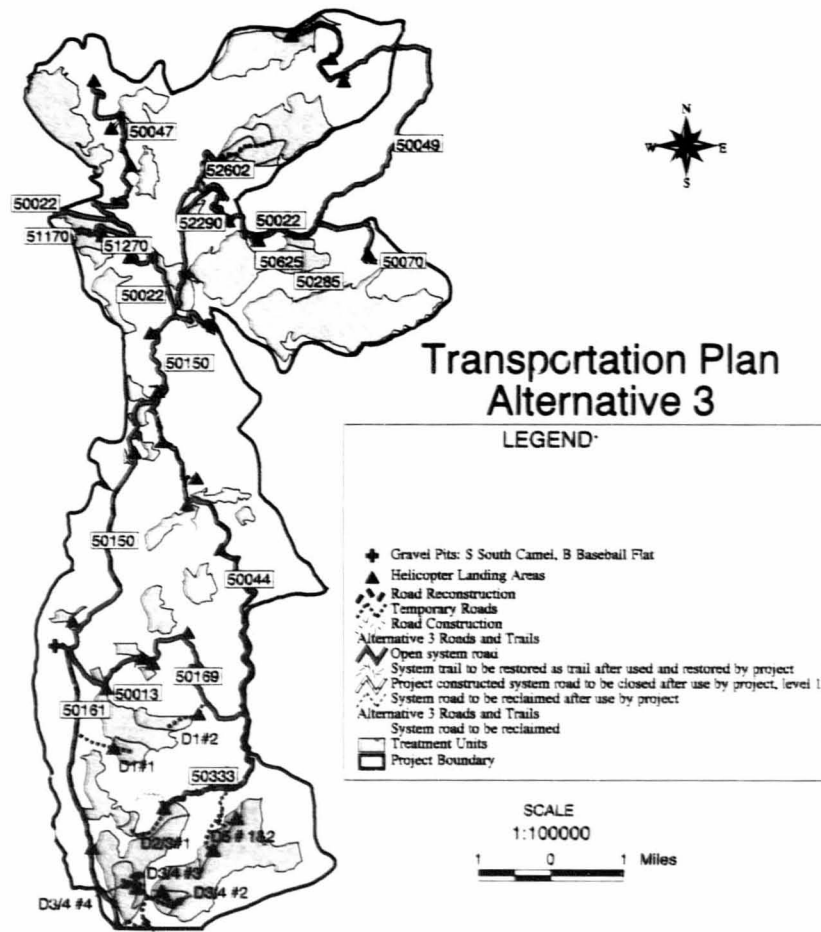
FIGURE F-1



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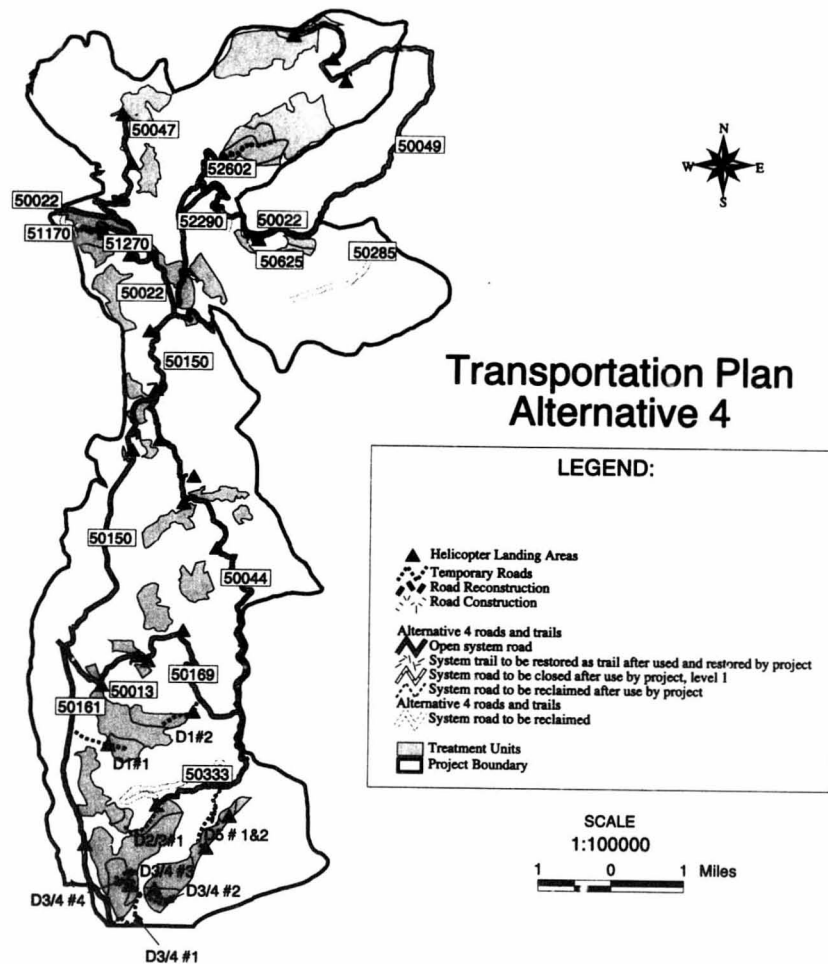
FIGURE F-2



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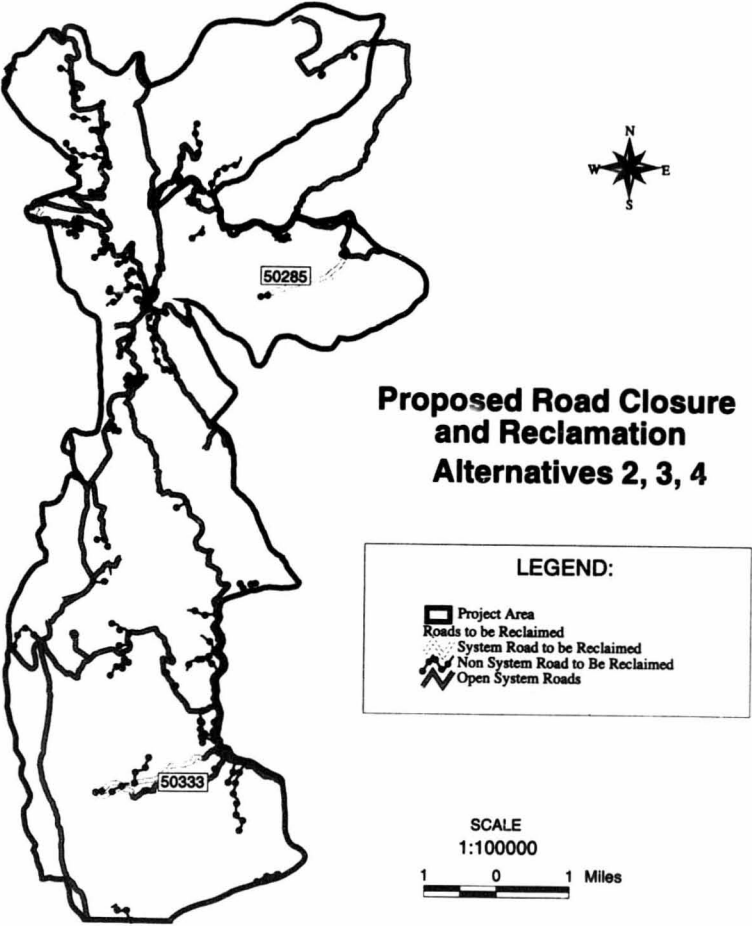
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FIGURE F-3



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FIGURE F-4



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APPENDIX G

PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS

Appendix G - Past, Present, And Reasonably, Foreseeable Future Actions

FIGURE G-1
Summary of Past Actions

MINERALS		
TIMING	PAST	ANTICIPATED EFFECTS
1970 - 2005	Camel Rock (North) Limestone Quarry (SE4NW4, Sec. 28, T. 19 S., R. 4 E., SLM); Pit = 3 ac.; 1,500 ft. of road x 30 ft. width = 1 ac.; Total Dist. = approx. 4 ac.	Vegetation has been removed and erosion has increased along the access roads. It would take approx. 5 years to restore understory vegetation to 90% of original ground cover following reclamation. 4 ac.
1985 - 2005	Camel Rock (South) Limestone Quarry (NE4NW4, Sec. 33, T. 19 S., R. 4 E., SLM) Pit = 3 ac. 2,500 ft. of road x 30 ft. width = 1.7 ac. Total Dist. = approx. 5 ac.	Same as Above. 5 ac.
1994 - 2005	Baseball Flat Limestone Quarry (NW4, Sec. 19, T. 20 S., R. 4 E., SLM); Pit = 2 ac.; 3,000 ft. of road x 25 ft. width = 1.7 ac.; Total Dist. = approx. 4 ac.	Same as Above. 6 ac.
1994 - 2005	High Top (North) Limestone Quarry (SE4, Sec. 5, T. 19 S., R. 4 E., SLM); Pit = 5 ac.; 700 ft. of road x 25 ft. width = 0.4 ac.; Total Dist. = approx. 6 ac.	Same as Above. 6 ac.
SOIL AND WATERSHED		
TIMING	PAST	ANTICIPATED EFFECTS
1965	A soil and water improvement project of about 360 acres was conducted on Ferron Mountain in the Mill Creek drainage of the Ferron Creek watershed in about 1965. The project consisted of contour trenching, which controlled excessive soil erosion that was occurring at the time.	This is a non-forested site that would not be affected by the proposed timber sale.
TRANSPORTATION		
TIMING	PAST	ANTICIPATED EFFECTS
1994, 1995	The Twelvemile sale has paid for the reconstruction of 840 feet of narrow and steep roadway and 3.85 miles of reconditioning of roadway on the Ferron-Mayfield road, #50022. Aggregate has been placed on 1.68 miles of road (4" layer) in this project area. Adds logging trucks and construction equipment to the traffic mix.	The above mentioned traffic mix will benefit from this construction effort in improved operational costs and continued access during wet weather conditions. The environment will benefit from reduced fugitive dust.
1994	The development of South Skyline Gravel Source (near Baseball Flat). Adds construction equipment to the Skyline Drive as well as placement of aggregate surfacing (also on Skyline Drive).	Continued placement of aggregate out of South Skyline Gravel Source improves the travelway on Skyline drive.
past	Dispersed recreation, rural recreation, cordwood activities, range activities, and timber activities have contributed to the seasonal traffic volumes in and around the project area.	Road surface displacement/contamination of aggregate, user developed roads.

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TIMBER		
TIMING	PAST	ANTICIPATED EFFECTS
1995	Ferron Reservoir Campground Sevimol Spray Project. Spray spruce trees with Sevimol within the campground. Section 22, T19S, R4E	Spruce trees would survive spruce beetle attacks.
1995	Ferron Reservoir Summer Home Area Sevimol Spray Project. Spray Engelmann spruce trees with Sevimol within the summer home area. Section 22, T19S, R4E	Spruce trees would survive spruce beetle attacks
1995-1996	Timber Canyon Gopher Control Project. Place strychnine treated oats in pocket gopher's underground burrows. About 85-90 acres were treated during the fall of 1995 and again in the spring of 1996. Section 7 and 8, T20S, R4E	Pocket gopher populations reduced. Higher survival of hand planted spruce seedlings.
1996 and 1999	Timber Canyon Timber Sale Reforestation. About 30,000 Engelmann spruce seedlings were hand planted over 85-90 acres during the spring of 1996. Fencing was installed to keep livestock out of both plantations for 10-15 years. Section 7 and 8, T20S, R4E.	Suitable timber sites satisfactorily re-stocked with spruce. Reforestation requirement of NFMA would be met. About 295-305 acres of range would be unavailable to livestock for 10-15 years.
1995	Timber Canyon Timber Sale Slash Disposal. About 200 acres would have logging slash piled by machine. Another 50 acres would be hand piled. Slash piles would be burned in the fall of 1995. Sections 7 and 8, T20S, R4E	Reduction of fuel loading. Air quality minimally affected by smoke for 1 to 2 days
1997	Twelvemile Timber Sale Slash Disposal. Slash within 200 feet of Ferron-Mayfield Road and Twelvemile Flat Campground would be hand piled. The area is about 11 acres with about 12 tons of slash per acre. Another 160-165 acres would have 2-3 tons per acre hand piled. Slash piles were burned in the fall of 1997. Section 29, T19S, R4E.	Reduction of fuel loading. Improve visual foreground appearance adjacent to Twelvemile Flat Campground and along the Ferron-Mayfield Road. Air quality minimally affected by smoke for 1 to 2 days.
Prior to 1980	No Name Timber Sale. Commercial timber harvest in Sections 17 and 18, T19S, R4E. About 40 acres.	Conifer tree stocking is unsatisfactory. Reforestation requirements of NFMA not met. Harvest area revegetated. Unauthorized ORV use occurring on former work roads and skid trails. Some erosion occurring on nonsystem roads/trails (about 1.25 miles or 1.75 acres).
6/19/79 - 12/19/82	Twelvemile Flat Timber Sale. Commercial harvest of 492 MBF of live Engelmann spruce and other species sawtimber from 80 acres. Section 29, T19S, R4E.	A residual sawtimber stand (120 + square feet of basal area) remained after harvest. Unauthorized ORV use occurring on former work roads and skid trails. Some erosion occurring on these roads/trails (about 1.5 miles or 2.0 acres).
10/93 - 06/94	Emerald Lake Timber Sale. Commercial salvage of 20 MBF of dead Engelmann spruce and other species sawtimber from 7 acres. Section 17, T20E, R4E.	Dead tree hazard removed from dispersed recreation area around Emerald Lake.
10/1992	Twelvemile Campground Sevimol Spray Project. Engelmann spruce trees infested with spruce bark beetles were cut and removed from the developed campground. The remaining uninfested spruce were sprayed with Sevimol. Section 29, T19S, R4E.	Spruce trees survived during the spruce bark beetle epidemic in surrounding areas.
09/1994	Emerald Lake Sevimol Spray Project. About 255 Engelmann spruce trees were sprayed with Sevimol in the dispersed recreation area around Emerald Lake. Section 17, T20S, R4E	Spruce trees survived during the spruce beetle epidemic in the surrounding areas.
09/21/92 - 01/13/97	Timber Canyon Timber Sale. Commercial salvage of 2,888 MBF of dead Engelmann spruce sawtimber. About 330 acres. Section 7 and 8, T20S, R4E	Timber Canyon T.S. Commercial salvage of 2,888 MBF of dead Engelmann spruce sawtimber. About 330 acres. Section 7 and 8, T20S, R4E. Monitoring tree survival on going
02/23/94 - 09/9/97	Twelvemile Timber Sale. Commercial salvage of 2,186 MBF of dead Engelmann spruce sawtimber. About 205 acres. Reconstruction of 3.85 miles of the Ferron-Mayfield Road (FDR 50022). Section 29, T19S, R4E	Timber harvest and post sale work completed. Monitoring tree survival on going.
09/03/96 - 12/31/97	Camel Timber Sale. Commercial salvage of 78MBF of dead Engelmann spruce sawtimber on 13 acres. Sections 29, 33, T19S, R4E.	Timber harvest and post sale work completed. Monitoring planted tree survival on going.

RANGELAND/WILDLIFE		
TIMING	PAST	ANTICIPATED EFFECTS
Late 1800's to mid-1900's	Historic grazing across most of the Manti Division.	Overgrazing and extensive human caused fires in the late 1800's caused extensive decreases in vegetation cover and diversity. These changes resulted in increased runoff, severe erosion, and frequent severe flooding and mudflows during the late 1800's and early 1900's (Reynolds, 1911). Intensive management since establishment of the Manti Forest in 1902 and 1903 has resulted in significant increases in vegetation diversity and biomass (Manti-La Sal N.F., 1992). The decrease in frequency of severe floods and mudflows, especially during the dry summer season, indicates that improved vegetation conditions have decreased the frequency of landslides but the potential is probably greater than it was before European settlement.
1989	Black Mountain Prescribed Burn; 800 ac.; S9,16,17 T19S R3E	Very spotty burn didn't remove much overstory. Regeneration of aspen is not very good. Sprouting is spotty. Similar to Sixmile.
1989	Wingely Hill Prescribed Burn; 1500 ac.; T19S R5E, S17,20,21,28,29,33,34	Aspen sprouting is good. Most sprouts 6 to 7 ft tall. In areas that burned hot there was some top soil loss. These areas were reseeded. Seeded areas have good ground cover and soil erosion has stopped. About 10% has not come back as expected (sprouting +/- 2ft. Black bark disappearing from trees. Woodcutters cleaning up area
1991	Julius Flat Prescribed Burn; 1500 ac.; about 650 actually burned; T20S R4E S25,26,27,34,35;	Varying vegetative conditions. Most areas aspen is sprouting up to 4 ft high. About 15% of the area is less successful. Mosaic looks good.
1992	Duck Fork Prescribed Burn; 460 ac.; S11,12 T19S R4E	About 10% of area hasn't come back as expected. Aspen sprouts over balance of burn is good. 4 ft high. Still notice dead standing trees. Woodcutters active in area.
1992	Six Mile Prescribed Burn; 800 ac.; S2 T19S R4E	Burn only about 50% successful hasn't come back as expected. Studies for burn are on file at Sanpete District Office. Standing bug trees add to mortality. Parts that burnt still visible. Some areas produce good forage.
1993	Beaver Prescribed Burn; 1600 ac.; T20S R3E, S7,9,16,17,18,19,20,21	Area was reseeded after a hot burn. Still looks like a burn. Aspen regeneration is spotty. New springs have developed. No erosion has been recorded. Wood and pole cutters have limited access.

RECREATION

TIMING	PAST	ANTICIPATED EFFECTS
Constructed in 1958.	Twelvemile Flat Campground has 17 developed campsites that are spread throughout a total of 8 acres.	
Rehabilitated in 1994.	Brought up to current ADA standards. Accessible tables, grills, and a four unit toilet were installed.	
Sprayed in 1992 and 1994.	The campground's spruce component infected with bark beetle was removed as hazard trees (106 total) and the remaining non-infested spruce were treated with pesticide. Trees received a second pesticide treatment.	In general the site is in good condition because of the mentioned rehab efforts. The Sanpete District Office reported that there are no negative effects from the campground to other resources at all.
Built in 1965	The recreation complex located in the immediate vicinity of Ferron Reservoir involves both public and private lands. The Forest Service maintains 30 campsites, a 1/2 mile long interpretive trail, and the Indian Creek Guard Station including a warehouse and generator building. The guard station contained asbestos which has been recently removed, and is presently being remodeled inside. The site encompass 43 acres.	The campsites are in good condition and all but 3 have universally accessible tables. Overall, the Forest Service facilities are in good shape.
	There is a small resort to the south of the reservoir composed of older cabins which are in relatively poor condition. Additionally, there are two phased subdivisions-one contains 4 older structures and the other 10 more recently built-all 14 are summer homes located on 1/4 acre lots and in good condition.	According to the Ferron District Office there are no negative effects to any other resources resulting from development and/or use at this reservoir. Problems with septic system at resort may be affecting water quality of Ferron Reservoir.
	Dispersed recreation sites: The flat water fisheries of relative importance to recreation in the project area are Duck Fork Reservoir, Emerald Lake, and Blue Lake. The other reservoirs are typically drawn down to marginal levels and are not stocked by UDWR. According to the Sanpete District Office the area at Twelve Mile Flat commonly used for dispersed recreation will be closed beginning the summer of 1995.	In consequence the type of use at these lakes and reservoir, and the ending of the dispersed use at Twelvemile Flat; negative effect to associated resources is nil.

FIGURE G-2
Summary of Present Actions

TIMING	PRESENT	ANTICIPATED EFFECTS
8/05/96 - present	Oiga Timber Sale. Commercial salvage of 369 MBF of dead Engelmann spruce saw timber on 173 acres. Reconstruction of roads in Sections 29 and 32, T.19S., R.4E. Section 5, T.20S., R.4E.	Timber harvest is mostly complete, erosion control, slash work, and tree planting will be completed during the 1999 field season.
09/03/96 - present	Oley Timber Sale. Commercial salvage of 898 MBF of dead Engelmann spruce saw timber on 151 acres. Reconstruction of roads in Sections 28, 29, 32, and 33, T.20S., R.4E.	Timber harvest is mostly complete, erosion control, slash work, and tree planting will be completed during the 1999 field season.
10/29/96 - present	Baldy Timber Sale. Commercial salvage of 5,888 MBF of dead Engelmann spruce saw timber on 498 acres. Construction and reconstruction of roads in Sections 7, 8, 17, 18, 32, and 33, T.19S., R.4E., Sections 4, 5, 8, 17, 18, and 19, T.29S., R.4E.	Road construction and reconstruction has been completed. Harvest started in 1997.
12/31/96 - present	Duck Timber Sale. Commercial salvage of 8,117 MBF of dead and infested Engelmann spruce saw timber on 726 acres. This sale will harvest timber using both tractor skidding and helicopter yarding. Construction and reconstruction of roads in Sections 11, 14, 15, 16, and 21, T.19S., R.4E., Sections 5, 9, 15, 16, 17, 19, and 20, T.20S., R.4E.	Road construction and reconstruction is on going. No timber harvest as taken place at this time.
12/31/96 - present	Six Timber Sale. Commercial salvage of 3,964 MBF of dead and infested Engelmann spruce saw timber on 351 acres. This sale will harvest timber using both tractor skidding and helicopter yarding. Construction and reconstruction of roads in Sections 7, 8, 17, 18, 19, 20, 21, 22, 26, 27, and 29, T.19S., R.4E.	Road construction and reconstruction is on going. Harvest started winter of 1998-1999.
1998-1999	Timber Canyon Gopher Control Project. Place strychnine treated oats in pocket gopher's underground burrows. 210-215 acres will be treated in the fall of 1998 and in the spring of 1999. Section 7 and 8, T.20S., R.4E.	Pocket gopher populations reduced. Higher survival of planted Engelmann spruce tree seedlings.
1999	Timber Canyon Timber Sale Reforestation. In 1999, 75,000 seedlings will be hand planted over 210-215 acres. Fencing will be installed to keep livestock out of both plantations for 10-15 years. Section 7 and 8, T.20S., R.4E.	Suitable timber sites are satisfactorily re-stocked with the Engelmann spruce component. Reforestation requirement of NFMA would be met. About 295-305 acres of range would be unavailable to livestock for 10-15 years.

MINERALS

TIMING	PRESENT	ANTICIPATED EFFECTS
	None	

SOIL AND WATER

TIMING	PRESENT	ANTICIPATED EFFECTS
	No soil and watershed improvement projects are being conducted in the project area.	Soil conditions have improved from past projects on Ferron Mountain.

RANGELAND/WILDLIFE

TIMING	PRESENT	ANTICIPATED EFFECTS
Fall 99	Jungle Prescribed Burn; 2000 ac. S18,19,13,24 T19S R4,4SE. Thick stand of spruce-fir with scattered aspen will be burned to rejuvenate aspen and understory vegetation.	Burn will be spotty and where it burns hot there may be soil loss until ground cover can be established, usually between 3 to 5 years.
Fall 99	Somlie Prescribed Burn; 3,000 acres T19S, R3E, Sections 32, 33, 34, T19S, R3E, Sections 1-6.	Burn would be mosaic. It is anticipated 85% of these acres would directly influence the vegetation. Forage production expected 1-5 years, wildlife cover after 5 years.

FIGURE G-3
Summary of Reasonably Foreseeable Future Actions
(within ten years; 1995-2005)

MINERALS	TIMING	REASONABLY FORESEEABLE	ANTICIPATED EFFECTS
		Two oil and gas exploration wells with no production wells or fields predicted: 2.25 ac. per well x 2 wells = 4.5 ac. for pads; 2 wells x 6.14 ac./well x 6 ac./mi. = 73.7 ac. for roads; Total Disturbance = 78.2 ac. It is not anticipated that any of the project roads would be converted to Forest Development Roads	It would take approximately 5 years for understory vegetation to reach 90% of the predisturbance ground cover following physical reclamation.
		The pits would be opened at some time within the next 10 years and remain for at least 10 years.	Open 2 new Limestone Quarries associated with other project needs; 3 ac. per pit x 6 ac./mi. of new road x 30 ft. width = 3.6 ac.; Total Dist. = approx. 10 ac.
			Vegetation would be removed and some erosion would occur. It would take approx. 5 years to restore predisturbance ground cover following physical reclamation.

GEOLOGY	TIMING	REASONABLY FORESEEABLE	ANTICIPATED EFFECTS
		Isolated landslides (low magnitude-high frequency) could occur during periods of average and below average precipitation cycles. Large magnitude-low frequency landslide and flood events similar to the 1983/1984 event could occur during above average precipitation cycles (more than one year) at a statistical frequency of 125 years.	Naturally occurring landslides have occurred for thousands of years and will continue to occur.
			Existing and future landslides are large producers of sediment, especially during periods of active movement in the spring.

SOIL AND WATERSHED	TIMING	REASONABLY FORESEEABLE	ANTICIPATED EFFECTS
		No soil and watershed improvement projects are anticipated in the foreseeable future.	Improvements to soil conditions are expected as a result of range management actions

RANGELAND/WILDLIFE	TIMING	REASONABLY FORESEEABLE	ANTICIPATED EFFECTS
	Fall 99	Prescribed Burn; Six Mile 2; 2000 ac. S1-2.3 T1-9S R4E	Varying vegetative conditions. Where fire is expected to burn hot (about 75%) aspen will be sprouting up. About 25% of the area will be less successful. Mosaic should look good.

FIRE	TIMING	REASONABLY FORESEEABLE	ANTICIPATED EFFECTS
		Isolated low intensity, high frequency fires could occur during periods of average and above average precipitation cycles. High intensity, low frequency fire events could occur during below average precipitation cycles at a statistical frequency of 150 to 300 years.	Naturally occurring fires have impacted the South Manti landscape for thousands of years and are expected to continue. Human caused fires are also reasonably foreseeable.
			Future high intensity, low frequency stand replacement fire events could reduce soil productivity, increase sedimentation, alter conditions of rangeland and forested vegetative communities and aquatic and wildlife habitats, and increase potential for landslides etc.

TRANSPORTATION	TIMING	REASONABLY FORESEEABLE	ANTICIPATED EFFECTS
	1995 - 2005	Increase in traffic and traffic mix.	Increased traffic on area roads, additional surfacing replacement needed, additional maintenance needed.
	1995 - 2005	Road improvement projects. Aggregate placement, road widening, sight distance improvement, additional turnouts, bridge paving, road stabilization, additional culvert placement/culvert replacement.	Continued user access, protection of resources and investments.

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APPENDIX H

STREAM CROSSINGS

APPENDIX H - STREAM CROSSINGS

Stream Name	Legal Description ^{1.}	Type of Road Work
Unnamed Tributary to Six Mile Creek	T19S, R4E, SWNE Sec 17	Reconstruction #51282
Unnamed Tributary to Indian Creek	T19S, R4E, SWSW Sec 21	Reconstruction #52290 ^{2.}
Little Horse Creek	T19S, R4E, NWNE Sec 26	Maintenance #50070 ^{2.}
Tributary to Little Horse Creek	T19S, R4E, NENW Sec 26	Maintenance #50285 ^{2.}
Tributary to Little Horse Creek	T19S, R4E, NESW Sec 27	Road Construction ^{2.}
Tributary to North Fork Muddy Creek	T20S, R4E, NESE Sec 5	Reconstruction #50044
Tributary to North Fork Muddy Creek	T20S, R4E, NWSW Sec 4	Reconstruction #50044
Headwaters of North Fork Muddy Creek	T20S, R4E, SWNW Sec 9	Reconstruction #50044
Beaver Creek	T20S, R4E, NENE Sec 21	Reconstruction #50044
Reservoir Creek	T20S, R4E, NENW Sec 28	Temporary Road
Fish Creek	T20S, R4E, SWNW Sec 28	Temporary Road
Fish Creek	T20S, R4E, NWSW Sec 27	Reconstruction #50044
Tributary to Slide Fork Creek	T20S, R4E, NWSW Sec 27	Reconstruction #50044
Slide Fork Creek	T20S, R4E, SWSW Sec 27	Reconstruction #50044
Black Fork Creek	T20S, R4E, NESE Sec 33	Temporary Road
Black Fork Creek	T20S, R4E, SESE Sec 33	Temporary Road
Mill Fork Creek	T20S, R4E, SWSE Sec 32	Temporary Road
Tributary to Mill Fork Creek	T21S, R4E, NWSW Sec 5	Temporary Road

1.

T = Township, S = South, R = Range, E = East
 SWNE = Southwest quarter of Northeast quarter of the section
 SWSW = Southwest quarter of Southwest quarter of the section
 SWNW = Southwest quarter of Northwest quarter of the section
 SESE = Southeast quarter of Southeast quarter of the section
 SWSE = Southwest quarter of Southeast quarter of the section
 NWNE = Northwest quarter of Northeast quarter of the section
 NENW = Northeast quarter of Northwest quarter of the section
 NESW = Northeast quarter of Southwest quarter of the section
 NESE = Northeast quarter of Southeast quarter of the section
 NWSW = Northwest quarter of Southwest quarter of the section
 NENE = Northeast quarter of Northeast quarter of the section
 Sec = Section

2.

Stream Crossing associated only with Alternative 2

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APPENDIX I

NATIONAL FOREST MANAGEMENT ACT CONSISTENCY

APPENDIX I - NFMA CONSISTENCY

Because this analysis involves vegetative management treatments NFMA compliance items covered under 36 CFR 219.27(b) "Vegetative Manipulation", 36 CFR 219.27(c) "Silvicultural Practices", and 36 CFR 219.27(d) "Even-aged Management" is summarized below:

Vegetative Manipulation

219.27 (b)(1): "Be best suited to the multiple use goals established for the area with potential environmental, biological, cultural resource, aesthetic, engineering, and economic impacts, as stated in the regional guides and forest plans".

In Chapter 4, each resource is evaluated as to how each alternative addresses multiple use goals that are inherent in the Forest Plan standards and guides (S&G). As described in these effects discussions, all action alternatives comply with Forest Plan S&G. The Forest Plan S&G are a product of the Regional guides developed specifically for the Manti-La Sal National Forest.

219.27 (b)(2): "Assure that lands can be adequately restocked as provided in paragraph (c)(3) of this section, except where permanent openings are created for wildlife habitat improvement, vistas, recreation uses and similar practices."

No permanent openings are being created by harvest activities under any alternative. There are no regeneration harvest treatments prescribed under any alternative. Any areas requiring regeneration are a direct result of spruce beetle activity and not directly caused by harvest activity.

219.27 (b)(3): "Not be chosen primarily because they will give the greatest dollar return or the greatest output of timber, although these factors will be considered."

While economics and outputs are considered, additional factors related to reducing the impacts of the spruce beetle and protection of resources within the project area as described in Chapters 3 and 4 will also be used to determine the best action to implement. The reasons for the decision will be fully described in the Record of Decision.

219.27 (b)(4): "Be chosen after considering the effects on residual trees and adjacent stands."

Areas proposed for treatment under the Action Alternatives were those most impacted by the spruce beetles, at the highest risk of future loss, and/or had potential to put other stands at risk if beetle activity continues. Effects on other stands and residual trees are discussed in Chapter 4, section 4.5.

219.27 (b)(5): "Avoid permanent impairment of site productivity and ensure conservation of soil and water resources."

SWCPs implemented in project design and contract initiation are designed to minimize impacts to site productivity and ensure conservation of soil and water resources. These are discussed in Chapter 4, sections 4.3 and 4.4 and Appendix B.2. Contract provisions will be used that implement SWCPs, such as directional felling, designated skid trails, landings, etc.

219.27 (b)(6): "Provide the desired effects on water quantity and quality, wildlife and fish habitat and other resource yields".

The analysis of the No Action Alternative shows that there would be an increase in water yield of 10 percent in the affected watersheds (Chapter 4, section 4.4). Salvage harvest (created openings) in the Action Alternatives would have no significant additive effects compared to the increases in water yield predicted under no action. Affects to water quality and fish habitat would be negligible from the Action Alternatives, due to the implementation of the required SWCPs.

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219.27 (b)(7): "Be practical in terms of transportation and harvesting requirements, and total cost of preparation, logging, and administration."

The transportation and harvest methods described are capable of being implemented, based on the Silvicultural information and transportation plan and feasibility report (Refer to the Project file). The economic analysis as outlined in Chapter 4 demonstrates that all costs are within expected revenues.

Silvicultural Practices

219.27 (c)(1): "No timber harvesting shall occur on lands classified as not suited for timber production pursuant to 219.14 except for salvage sales. These lands shall continue to be treated for reforestation purposes if necessary to achieve the multiple-use objectives of the plan."

This has been discussed under the section 3.6 Forest Health, Diversity, and Productivity. Based on discussions in this section, all harvest activities proposed are in full compliance with this management requirement.

219.27 (c)(2): "The selected sale schedule provides the allowable sale quantity for the first planning period. Within the planning period, the volume of timber to be sold in any one year may exceed the annual allowable sale quantity so long as the total amount does not exceed the allowable sale quantity. Nothing in this paragraph prohibits salvage or sanitation harvesting of timber stands which are substantially damaged by fire, windthrow, or other catastrophe, or which are in imminent danger of insect or disease attack and where such harvests are consistent with silvicultural and environmental standards. Such timber may either substitute for timber that would otherwise be sold under the plan or, if not feasible, be sold over and above the planned volume."

Portions of the volume to be sold under the Proposed Action or other Action Alternatives may contribute to the allowable sale quantity (ASQ) for the first planning period for the Forest Plan. Sale of any volume proposed under the Proposed Action or Action Alternatives would not result in exceeding the ASQ for the planning period because salvage or sanitation harvesting may either substitute for timber that would otherwise be sold under the plan or, if not feasible, be sold over and above the planned volume.

Volumes sold off of lands classified as unsuited for timber harvest would not contribute to the ASQ. Refer to "Forest Land Suitability" for acres classified as unsuitable.

219.27 (c)(3): "When trees are cut to achieve timber production objectives, the cuttings shall be made in such a way as to assure that the technology and knowledge exists to adequately restock the lands within 5 years after final harvest. Research and experience shall be the basis for determining whether the harvest and regeneration practices planned can be expected to result in adequate restocking".

NFMA requires that timber be harvested from National Forest Systems lands only where there is assurance that such lands can be adequately restocked within 5 years of final harvest (16 U.S.C. 1604).

Under the Proposed Action, and other Action Alternatives, dead, dying and spruce beetle infested trees are being cut. Only in the areas where spruce beetle populations have killed substantial numbers of trees would an unstocked opening be created, and regeneration activity be necessary. Regeneration in these areas is not a result of silvicultural treatments aimed at achieving timber production objectives, but are a result of site rehabilitation on areas impacted by a major disturbance event (spruce beetle infestation). Therefore, the NFMA 5 year requirement does not apply to regeneration activities proposed under the Proposed Action, or any Action Alternative.

Monitoring would be used to assess the success of regeneration efforts following project completion. Desired results and forest plan standards would be specifically stated in the detailed silvicultural prescriptions written for each area. The details of the monitoring plan are in Appendix D-3.

Although the Manti-La Sal National Forest has had limited experience planting in these forest types, experience from forests of similar elevation and habitat types indicates stands in the project area requiring regeneration activity following implementation of the Proposed Action, or other Action Alternatives, can be successfully regenerated in accordance with the National Forest Management Act (NFMA 1976) requirements.

219.27 (c)(4): "Cultural treatments such as thinning, weeding and other partial cutting may be included in the forest plan where they are intended to increase the rate of growth of remaining trees, favor commercially valuable tree species, favor species age classes which are most valuable for wildlife, or achieve other multiple-use objectives."

No commercial thinning treatments are proposed in any of the alternatives. Some release and weeding cultural treatments are included in the design features of the action alternatives. These treatments are in compliance with the objectives stated in 219.27 (c)(4) and Forest Plan S&Gs.

219.27 (c)(5): "Harvest levels based on intensified management practices shall be decreased no later than the end of each planning period if such practices cannot be completed substantially as planned."

This applies to Forest Plan level decisions, not to project level decisions.

219.27(c)(6): "Timber harvest cuts designed to regenerate an even-aged stand of timber shall be carried out in a manner consistent with the protection of soil, watershed, fish ...resources, and the regeneration of the timber resource".

No treatments designed to regenerate even-aged stands are proposed under the Proposed Action or other Action Alternatives. However, as discussed in Chapters 3 and 4, the SWCP's are designed to protect soil, water, and instream resources. Pertinent SWCP's are retention of adequate ground cover, harvest restrictions in critical soil and watershed areas, wet condition restrictions, designated skid trails, and ripping of skid trails.

219.27 (c)(7): "Timber harvest and other silvicultural treatments shall be used to prevent potential damaging population increases of forest pest organisms. Silvicultural treatments shall not be applied where such treatments would make stands susceptible to pest-caused damage levels inconsistent with management objectives."

The purpose and need for this action is defined to 1) Reduce the potential for large and intense wildfires across forest areas and to 2) Facilitate rapid reestablishment of Engelmann spruce through replanting of spruce in timber management units identified in the Forest Plan. Damaging (epidemic) population levels of spruce beetle have already been reached in the project area with associated high mortality levels in the large diameter Engelmann spruce trees. No proposed treatments will make stands susceptible to further damage from spruce beetle.

Even-Aged Management

OPTIMIZATION OF CLEARCUTTING: The National Forest Management Act states that clearcutting is to be used on National Forest System lands only where it is determined to be the optimum method.

The Manti-La Sal National Forest has interpreted this requirement to mean that clearcutting would be used only where it is consistent with the Forest Plan standards and guidelines, and where it would accomplish Forest Plan objectives that cannot be accomplished through other harvest methods.

Salvage of dead and dying trees is the only proposed harvest treatment under the Proposed Action, or other action alternatives. Clearcutting is not a proposed treatment. Some areas have been, or are being heavily impacted by spruce beetle. Insect infested trees and a portion of the dead trees would be removed in these areas. This may result in some areas being "under-stocked" (not fully meeting desired trees per acre or desired species composition goals) due to spruce beetle activity. Live, non-infested trees would not be removed from these areas. Damage to live trees that have survived the bark beetle infestation would be minimized by strict adherence to contract requirements for protection of residual green trees. No clearcuts or large human-created even-age openings are planned or proposed through harvest of live trees. Some areas

under-stocked because of spruce mortality, where dead spruce are salvaged, may appear as clearcuts following harvest treatments.

APPROPRIATENESS OF EVEN-AGED MANAGEMENT: The National Forest Management Act (NFMA) places special requirements on the use of even-aged silviculture systems on National Forest Systems lands. This is contained in NFMA (16 USC 1604 (g)(3), (F) and (i)) which states that "cuts designed to regenerate an even-aged stand of timber would be used as a cutting method only where such cutting is determined to be appropriate, to meet the objectives and requirements of relevant land management plan."

The Forest Plan (p. III-27) allows use of evenaged (shelterwood) or unevenaged (group or single tree selection) methods in spruce-fir. In some areas, spruce beetles have, or are projected to kill a large proportion of the overstory, creating a more even-aged condition. However, an option would still exist in the future for managing these stands for uneven-aged structures depending on desired conditions at that time; it would just take longer for them to achieve an uneven-aged distribution.

219.27 (d)(1): "Openings shall be located to achieve the desired combination of multiple-use objectives. Regional Guides shall provide guidance on dispersion of openings. As a minimum, openings in forest stands are no longer considered openings once a new forest is established. Forest plans may set forth variations to this minimum based on site-specific requirements for achieving multiple-use objectives. Regional guides shall provide guidance for determining variations to this minimum in the Forest Plan".

Refer to the discussion under 219.27 (d)(2), below.

219.27 (d)(2): "Individual cut blocks, patches, or strips shall conform to the maximum size limits for areas to be cut in one harvest operation established by the Regional Guide. This limit may be less than, but will not exceed, 40 acres for all other forest types except as provided in paragraphs (d)(2)(i) through (iii) of this section. (i)- Cut openings larger than those specified may be permitted where larger units will produce a more desirable combination of net public benefits (ii)- Size limits exceeding those established in paragraphs (d)(2) and (d)(2)(i) of this section are permitted on an individual timber sale basis after 60 days' notice and review by the Regional Forester, (iii)- The established limit shall not apply to the size of areas harvested as a result of natural catastrophic condition such as fire, insect and disease attack, or windstorm."

The Regional Guide for the Intermountain Region (1984), page 3-21, states "An opening created in the Forest by application of even-aged management that exceeds 40 acres will require Regional Forester approval. Where such openings exceed 60 acres in size to produce a more desirable combination of net public benefits, they will be subject to a 60 day public review, except where a catastrophe exists. Regional Forester review and approval is required for harvesting larger units under catastrophic conditions. Appropriate public notice will also be given....(e) Evidence of a catastrophic condition must be reviewed and approved by the Regional Forester, if created openings will exceed 60 acres.

The Forest Vegetation Simulator (FVS) was used to project vegetation structural stages to estimate potential effects resulting from high levels of spruce mortality on stand structure. FVS projections indicated that some treatment units may be classified as openings as a result of the spruce beetle epidemic and mortality of the larger Engelmann spruce. This does not mean that these areas would qualify as clearcuts or continuous even-age stand treatments. Comparison of these areas with post treatment inventory of the Twelve Mile and Timber Canyon Salvage areas indicate that the majority of these stands would retain 10 to 40 square feet of basal area (primarily subalpine fir). Some residual Engelmann spruce would be present. This would maintain a forested structure in some areas, and limit the size of continuous openings resulting from spruce mortality and salvage harvest. On the ground reviews of the project area have validated the presence of residual stocking and that no group openings would be greater than 40 acres within any of the proposed treatment units. Generally, most of the openings would be less than 10 acres in size.

These areas of open stand conditions are a direct result of the impacts created by the spruce beetle epidemic and subsequent mortality of the Engelmann spruce. Harvest operations proposed in these stands would not cause any increase in opening size as a result of spruce mortality.

APPENDIX J

BIOLOGICAL ASSESSMENT

APPENDIX J - BIOLOGICAL ASSESSMENT

FERRON/PRICE & SANPETE RANGER DISTRICTS
MANTI-LA SAL NATIONAL FOREST
BIOLOGICAL ASSESSMENT
FOR
FEDERALLY LISTED PLANT AND ANIMAL SPECIES
FOR
FOREST SERVICE PROPOSAL FOR THE SOUTH MANTI
TIMBER SALVAGE SALES

Prepared by
Steve Romero
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Approved by:

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Rod Player Date
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Robert M. Thompson Date
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I. INTRODUCTION

The purpose of this biological assessment is to evaluate the potential effects of the Forest Service's proposed salvage timber sale on Threatened, Endangered, and proposed plant and animal species that may occur within the area.

The Endangered Species Act of 1973 (PL 93-205, as amended) requires federal agencies to ensure that any activities they authorize, fund, or carry out, do not jeopardize the continued existence of any wildlife species federally listed as Threatened or Endangered (Section 7). This biological assessment is an analysis of which Threatened, Endangered, or Proposed species may occur in the project areas and whether any impacts on those species are anticipated. This biological assessment is prepared using direction from the Forest Service Manual 2672.4. Discussions with Utah Division of Wildlife Resources, U.S. Fish and Wildlife Service, and staff with the USDA Forest Service also provided information for this assessment.

II. PROPOSED ACTION & ACTION ALTERNATIVES

Alternative 1, the No Action Alternative, will not be discussed in this document. Maps of alternatives 2, 3, and 4 can be found in Chapter 2 of the Environmental Impact Statement.

Alternative 2 - Relationship to Purpose and Need Proposed Action

Alternative 2 addresses the identified purpose and need by reducing the fuel loading across 6,530 acres, facilitating rapid reestablishment of spruce trees through planting harvested areas within Timber Management Emphasis Units identified in the Forest Plan, and recovering some economic value of the dead and dying trees (32 to 42 MMBF).

Alternative Development

Two conceptual minor modifications have been made to this alternative since it was presented for initial comment in February 1998. Approximately 64 acres have been dropped from harvest consideration because of the presence of goshawk nests in the previously identified units A5 (14 acres) and the eastern part of F3 (50 acres). Yarding methods have been refined based on additional field review - including optional cable yarding of helicopter yarding areas with adequate access (A3 (39 acres) and F1 (76 acres)).

Commercial Treatment Activities

Commercial Treatment Acreage: Alternative 2 would salvage harvest dead and dying spruce trees across approximately 6,530 treatment acres. Past experience indicates that 50 to 65 percent of the treatment area is likely to be harvested (3,200 to 4,200 acres). The actual harvest acreage is less than the treatment area because of stand and site conditions (e.g. areas of non-spruce tree species, natural openings, meadows, rock outcrops), resource protection (riparian areas, steep slopes, unstable ground), and economic feasibility.

Location of Commercial Treatment: Approximately 3,988 treatment acres are located outside of inventoried roadless areas. Approximately 1,070 treatment acres are located within RARE II inventoried roadless areas. Approximately 1,472 treatment acres are located within a Forest Plan inventoried roadless area (Heliotrope).

Type of Commercial Treatment: All tree removal would be by a selective salvage harvest of dead and dying spruce trees. Felled timber would be yarded from within the unit to landing areas by various yarding methods: ground-based (1,617 acres), cable/helicopter option (115 acres), and helicopter (4,798 acres).

By-Product Recovery: With an estimated minimum by-product recovery of 10 thousand board feet (MBF) per acre, approximately 32 to 42 million board feet (MMBF) of timber could be recovered. Actual recovered volume may vary.

Timing: This alternative would take approximately 6 calendar years to implement the removal of included timber through multiple timber sales. The normal operating season would be July 1st to October 1st. Associated fuel reduction and initial reforestation activities (scarification and planting) would be completed within 1 to 2 years after harvest operations.

Transportation System

Roads would be required for project activities such as harvest implementation, post-harvest activities, reforestation, monitoring, and fuelwood management.

The following road work has been identified as part of this alternative: Forest Development Road construction (1 mile); Forest Development Road reconstruction (15 miles); constructed Forest Development Road closed to Level 1 maintenance (1 mile); project temporary roads to be built and reclaimed (8 miles); Forest Development Roads to be reclaimed (4 miles), and; nonsystem roads and motorized trails to be reclaimed (18 miles). Road and trail reclamation would occur as funds become available.

Some of the identified road work would be in inventoried roadless areas.

RARE II Inventoried Roadless Areas

No permanent or temporary road work would occur in RARE II inventoried roadless areas.

Forest Plan Inventoried Roadless Areas

Road construction (Forest Development Road #52362 (1 mile)), road maintenance (Forest Development Roads # 50070 (0.5 miles) and #50385 (0.3 miles)), and temporary roads would be allowed in the Heliotrope Forest Plan inventoried roadless area. The included road maintenance would make the specified roads suitable for hauling timber

Forest Development Road, nonsystem road, and nonsystem motorized trail density would decrease from 2.4 miles of road/trails per square mile to 1.8 miles of road/trails per square mile after full implementation of the project. Approximately 70 miles of roads and trails would remain open to motorized use after full implementation of the project. No system motorized trails would be permanently closed that are currently open.

Gravel for road work and maintenance would be obtained from one of two approved sites (South Camel, Baseball Flat) or off-Forest sources.

Post-Harvest Activities

Post-harvest fuels would be reduced across 6,530 acres by hand or with ground-based equipment. Activities would include piling and burning, prescribed jackpot burning, and/or logging and scattering.

Natural (1,888 acres) and artificial (planting) (1,133 acres) reforestation activities would be used to restock harvested areas as needed. Natural reforestation may include machine scarification of the site. Gopher populations would be reduced as necessary using properly applied lethal methods of strychnine to assure reforestation success. Gopher control treatment has been estimated for approximately 1,246 acres. Permitted sheep and livestock would be managed to protect reforestation from unacceptable damage.

Removal of fuelwood would continue by using existing roads.

Alternative 3 - Relationship to Purpose and Need

Alternative 3 addresses the identified purpose and need by reducing the fuel loading across 6,530 acres, facilitating rapid reestablishment of spruce trees through planting harvested areas within Timber Management Emphasis Units identified in the Forest Plan, and recovering some economic value of the dead and dying trees (32 to 42 MMBF).

Relationship to Significant Issue

Alternative 3 is responsive to Issue #15 (Impacts to Roadless Character) by: 1) not allowing road construction, reconstruction, or temporary roads in inventoried roadless areas; 2) allowing only helicopter yarding in inventoried roadless areas, and; 3) not allowing mechanical fuels reduction or site preparation in inventoried roadless areas.

Commercial Treatment Activities

Commercial Treatment Acreage: Alternative 3 would salvage harvest dead and dying spruce trees across the same 6,530 acres as Alternative 2. The actual harvest acreage (3,200 to 4,200 acres) is less than the treatment area for the same reasons as Alternative 2.

Location of Commercial Treatment: The location of treatment areas are the same as for Alternative 2, both outside of and within inventoried roadless areas.

Type of Commercial Treatment: All tree removal would be by a selective salvage harvest of dead and dying spruce trees. Felled timber would be yarded from within the unit to landing areas by various yarding methods: ground-based (1,067 acres), cable/helicopter option (115 acres), and helicopter (5,348 acres). Differing from Alternative 2, Harvest within inventoried roadless areas would require helicopter yarding.

Alternative 3 may require more areas for helicopter landing areas than Alternative 2.

By-Product Recovery: The estimated timber volume that could be recovered would be the same as Alternative 2, if all areas were treated. Because of the increased amount of helicopter yarding, market conditions and economics may not support the sale of all timber.

Timing: Alternative 3 could take as long as Alternative 2 to complete under the same conditions (up to 6 years to harvest followed by 2 years of post-harvest activity).

Transportation System

Alternative 3's road management is similar to Alternative 2 with the following exceptions:

1. Alternative 3 would not construct 1 mile of Forest Development Road #52362 in the Heliopore Forest Plan inventoried roadless area, and there would therefore be no resulting classification of it to maintenance level 1.
2. Alternative 3 does not allow temporary roads within inventoried roadless areas.

Post-Harvest Activities

Alternative 3's post-harvest activities are the same as Alternative 2, except that there would be no mechanical fuels reduction or site preparation within inventoried roadless areas. Hand treatment of site and fuels would have to be used within inventoried roadless areas.

Alternative 4 - Relationship to Purpose and Need

Alternative 4 addresses the identified purpose and need by reducing the fuel loading across 3,974 acres, facilitating rapid reestablishment of spruce trees through planting harvested areas within Timber Management Emphasis Units identified in the Forest Plan, and recovering some economic value of the dead and dying trees (20 to 26 MMBF).

Relationship to Significant Issue

Alternative 4 is responsive to Issue #15 (Impacts to Roadless Character) by not allowing timber harvest and road construction in inventoried roadless areas - RARE II and Forest Plan. Timber harvest and associated activities (e.g. road construction/reconstruction, mechanical site preparation) within inventoried roadless areas are not a part of this alternative.

Commercial Treatment Activities

Commercial Treatment Acreage: Alternative 4 would salvage harvest dead and dying spruce trees across approximately 3,974 treatment acres. Past experience indicates that 50 to 65 percent of the treatment area is likely to be harvested (2,000 to 2,600). The actual harvest acreage is less than the treatment area for the same reasons as Alternative 2.

Location of Commercial Treatment: The location of treatment areas are the same as for Alternative 2, except that no harvest would occur within inventoried roadless areas.

Type of Commercial Treatment: All tree removal would be by a selective salvage harvest of dead and dying spruce trees. Felled timber would be yarded from within the unit to landing areas by various yarding methods: ground-based (1,067 acres), cable/helicopter option (115 acres), and helicopter (2,792 acres).

By-Product Recovery: With an estimated minimum by-product recovery of 10 thousand board feet (MBF) per acre, approximately 20 to 26 million board feet (MMBF) of timber could be recovered. Actual recovered volume may vary depending upon stand and market conditions at the time of implementation, and if all timber were sold.

Timing: This alternative could take approximately 5 calendar years to implement the removal of included timber through multiple timber sales. The normal operating season would be July 1st to October 1st. Associated fuel reduction and initial reforestation activities (scarification and planting) would be completed within 1 to 2 years after harvest operations.

Transportation System

Same as Alternative 3, except that no road construction, road reconstruction, or maintenance associated with timber harvest would occur within inventoried roadless areas.

Post-Harvest Activities

Same as Alternative 2, except less acres would be treated. Fuel reduction would occur across 3,974 acres. Natural (1,160 acres) and artificial (planting) (696 acres) reforestation activities would be used to restock harvested areas as needed. Gopher control treatment has been estimated for approximately 766 acres.

III. SPECIES POTENTIALLY AFFECTED BY THE PROJECT

Known or Possible Threatened, Endangered, and Proposed Plants and Animals on the Ferron/Price & Sanpete Ranger District:

SPECIES

Canada lynx (*Lynx canadensis*)
Bald Eagle (*Haliaeetus leucocephalus*)
American Peregrine Falcon (*Falco peregrinus anatum*)
Southwestern Willow Flycatcher (*Empidonax traillii eximius*)
Heliotrope Milk-Vetch (*Astragalus montii*)

CLASSIFICATION

* Proposed/Threatened
Threatened
Endangered
Endangered
Threatened

Note: The above species lists was derived from a U.S. Fish and Wildlife Service (USFWS) list of threatened, endangered, and proposed species that may be present in the general Wasatch Plateau area, describing species and habitat in Utah by County. This list was received January 7, 1998 and is the current list used (Martinez, pers. comm. 1998).

* The Canada lynx was proposed for listing as threatened by the US Fish and Wildlife Service on July 8, 1998 therefore, because the Wasatch Plateau is within the historic range, it was added to the list of species to evaluate in this assessment.

IV. SPECIES OCCURRENCES AND HABITAT NEEDS

Canada Lynx

The Canada lynx, the only lynx in North America, is a solitary, secretive forest-dwelling cat of northern latitudes and high mountains. There it feeds primarily on small mammals and birds, and is especially dependent on snowshoe hare for prey. It was historically found throughout much of Canada, the forests of northern tier States, and subalpine forests of the central and southern Rockies. There is only one historic record of a lynx specimen from the Wasatch Plateau (Durrant, 1952). There have been no recorded sightings, or specimens from the Wasatch Plateau in recent years, in fact the specimen cited above is the only recorded instance of lynx on the Wasatch Plateau (Bates, 1999). This lack of occurrences indicates that there never has been a large population of lynx on the Wasatch Plateau.

The Lynx is a medium-sized cat, similar to the bobcat, but appears somewhat larger. It has longer hind legs and very large well-furred paws, adaptations to the deep winter snows typical throughout its range. It also has unique long tufts of the ears and a short, black-tipped tail. Measurements for adult males average 22 lbs. in weight and 33.5 inches in length with an average weight for females at 19 lbs. and 32 inches in length. The home range of a lynx can be up to 100 square miles (USFWS, 1998).

In the West, lynx live primarily in coniferous forests, but have been seen occasionally on arid rangelands. While mature forests with downed logs provide cover for denning, escape and protection from severe weather, it's believed that lynx sometimes will move to rangelands or transition areas between rangelands and mountain forests in pursuit of food. Lynx tend to avoid open spaces and prefer traveling in corridors that provide cover. The Wasatch Plateau does not contain large contiguous tracts of suitable forested habitat. However, it does contain large tracts of forest. Largely, because of fire suppression the forest habitats are lacking in diversity with an over-abundance of mature forests. While mature forests are important to lynx for denning and shelter, the younger age class forests provide habitat for the majority of prey species. Accordingly, ideal lynx habitat contains a diversity of age classes and forested cover types (Novak et al. 1987).

West wide development and urbanization, forest fire suppression and unsuitable types of forest management have caused the loss of the lynx's forest habitat. In recent years, recreation and road access has increased the number of people in the forests. Such activities create packed snow trails that allow bobcats and coyotes to enter the deep snow habitat, traditionally the domain of lynx, and out compete lynx for food and space. Similar impacts have occurred on the Wasatch Plateau.

There have been no surveys conducted specifically for Canada lynx on the Wasatch Plateau due to the lack of evidence (historic and recent sightings) that they inhabit the plateau.

Bald Eagle

During the breeding season Bald Eagles are generally closely associated with water, along coasts, lakeshores, or river banks. During the winter Bald Eagles tend to concentrate wherever food is available. This usually means open water where fish and waterfowl can be caught. They also winter on more upland areas feeding on small mammals and deer carrion. At winter areas, Bald Eagles commonly roost in large groups. These communal roosts are located in forested stands that provide protection from harsh weather (Stalmaster, 1987).

Bald Eagles are occasionally found near the lakes and reservoirs in the analysis area, during the late fall and early winter (October-mid December). Here they prey upon fish and waterfowl. When the lakes and reservoirs freeze over eagles leave the analysis area. No Bald Eagles are known to nest on the Forest. However, there is an active Bald Eagle eyrie near the town of Castle Dale, approximately 24 miles east of the project area. During 1993, the nesting territory was observed to determine the foraging area and fledgling area. None of these activities were observed on National Forest System lands.

American Peregrine Falcon

Peregrines occupy a wide range of habitats. They are typically found in open country near rivers, marshes, and coasts. Cliffs are preferred nesting sites, although reintroduced birds now regularly nest on man-made structures such as towers and high-rise buildings. Peregrines are known to travel more than 18 miles from the nest site to hunt food. However, a 10 mile radius around the nest is an average hunting area, with 80 percent of the foraging occurring within a mile of the nest. Peregrine falcons prey on a wide variety of birds including shorebirds, waterfowl, grouse, and pigeons (Ratcliffe, 1980; and Cade et al. 1988).

Migrating or transient, peregrines have been seen on the Wasatch Plateau. In 1996, surveys conducted by U.S. Forest Service, Utah Division of Wildlife Resources, and PacifiCorp Company discovered peregrines exhibiting nesting behavior in Cottonwood Canyon (approximately 4 miles east of Joes Valley Reservoir). The pair was observed copulating and defending a territory however, egg laying and incubation did not occur at this site. Additional surveys (1996) conducted by Forest Service personnel found a pair of peregrines occupying a territory on the east rim of South Horn Mountain (approximately 6 miles southeast of Joes Valley Reservoir). This pair was found using the cliff systems directly below the existing electronic site. In 1996 the Utah Division of Wildlife Resources discovered an active peregrine nest near the Star Point Mine (approximately 10 miles southeast of Price, Utah). The nest was occupied with eggs but it is not known if the nest produced young. Other nest and territories occur near the east bank of Joes Valley Reservoir and Link Canyon on the southern end of the Ferron/Price Ranger District. These nesting areas are inventoried annually. There are no known Peregrine Falcon nest sites in the South Manti timber sale area. Nesting habitat is very limiting. Any birds observed in the analysis area would be incidental.

Southwestern Willow Flycatcher

The Southwestern Willow Flycatcher is found mainly in the southwestern United States extending its range to the lower one-fourth of the state of Utah. These flycatchers are closely associated with riparian habitat such as willow or alder thickets along streams, on the shores of ponds, or bordering marshy areas. They are also found in the brushy margins of fields, along mountain streams, and in shrubby floodplain areas. They prefer areas of high shrub densities interspersed with openings or meadows. The woody component of their habitat is almost exclusively deciduous including willows, alders, cottonwoods, aspens, and shrubs such as chokecherry, hawthorn, sumac and wild rose. As the name implies, Southwestern Willow Flycatchers are insectivores, eating wasps, bees, beetles, flies, moths and butterflies (Unitt 1987).

Surveys for Southwestern Willow Flycatchers have been conducted within the Ferron/Price & Sanpete Ranger Districts. Willow Flycatchers were detected in some of the areas surveyed (Fish Creek (Scofield tributary), and Upper Joes Valley). However, it is not known if the Willow Flycatchers detected in those areas were Southwestern Willow

Flycatcher or *Empidonax traillii adastus* (northern variety). Sonogram and DNA samples were taken from those populations to determine the species of willow flycatcher. Areas of known suitable habitat for Willow Flycatchers occur at Pete's Hole, Chicken Creek, Huntington Canyon. There are some areas within the analysis area that appear to be suitable habitat (near Julius Flat Reservoir).

Excerpts from the proposed rule that appeared in Federal Register, Vol. 28, No. 140, 7/23/93 indicated the Ferron/Price Ranger District is outside the range of this species. Discussions with the U.S. Fish and Wildlife Service (May 1997) indicate no known presence of Southwestern Willow Flycatcher within the area. Sonogram testing of the Fish Creek population indicate the Willow Flycatchers detected there are probably not Southwestern Willow Flycatchers but the *Empidonax traillii adastus* species (Sedgewick, pers. comm. 1998).

Heliotrope Milkvetch

Habitat occurring within the Ferron/Price Ranger District, this plant is only found at high elevations (10,000 to 11,000 ft.) on Flagstaff limestone outcrops. Associated with low growing subalpine vegetation, populations are located on top of Heliotrope, Ferron, and White Mountains. These areas are within and adjacent to the analysis area.

V. DETERMINATION OF EFFECTS

Suitable Habitats

The analysis area does not contain suitable habitat (i.e. elevation, vegetation, season, and/or geology) for one of the species in the above list. Therefore, it is determined that there will be no effect upon it. The species, described below, is eliminated from further analysis.

Falco peregrinus anatum - the Peregrine Falcon is known not to occur within the analysis area. Nesting habitat is generally not available. Foraging could occur but would be incidental.

The potential for effects upon the following species will be analyzed further:

Canada lynx (*Lynx canadensis*)
Bald Eagle (*Haliaeetus leucocephalus*)
Southwestern Willow Flycatcher (*Empidonax traillii extimus*)
Heliotrope Milk-vetch (*Astragalus montii*)

Effects of the Timber Salvage

Canada lynx (*Lynx canadensis*)

None of the alternatives would impact lynx directly because there is no evidence that lynx currently are found in the analysis area. However, all of the action alternatives would have an impact on potential lynx habitat. These impacts would be both beneficial and adverse. The beneficial impacts would be as a result of reforestation efforts that would more quickly re-establish suitable lynx habitat. The early seral stages would benefit snowshoe hare a primary prey species of lynx. The adverse impacts would be as a result of the increased human disturbance during winter activities that would improve conditions for coyotes and bobcats which would then increase competition between lynx and these species for prey.

Bald Eagle (*Haliaeetus leucocephalus*)

None of the action alternatives should have a noticeable adverse effect on Bald Eagles. The foraging activities of the Bald Eagles nesting near Castle Dale do not occur on the Forest (UDWR, 1995). One possible impact would be a disturbance factor to migrating Bald Eagles foraging in the late fall and early winter if helicopter activity is allowed beyond the normal operating period of October 1. Impacts could come from helicopters disrupting the foraging behavior of eagles near the lakes and reservoirs prior to the lakes freezing over. If helicopter activity is permitted from

October 1 through November 15, eagle activity will be monitored within the area and helicopter flights will not be allowed within 1/2 mile (line-of-site) areas where foraging eagles are found.

Underground treatment of gophers will occur only where needed. The most effective and the least likely method to cause damage to wildlife is underground baiting. Underground baiting for gopher control using strychnine presents minimal hazards to nontarget wildlife, either by direct consumption of bait or by eating poisoned gophers (Hygnstrom et. al., 1994).

Southwestern Willow Flycatcher (*Empidonax traillii extimus*)

None of the action alternatives will have an effect on Southwestern Willow Flycatchers. Although there is potential habitat within the analysis area, no harvest activity will occur within riparian/willow areas. For perennial streams, no harvest will occur within 100 feet. For intermittent streams, no harvest will occur within 35 feet, and no mechanical entry will be allowed within 50 feet. The Forest Service species list requested (January 1998) from the U.S. Fish and Wildlife Service indicates Southwestern Willow Flycatcher is not known to be present within Sanpete County (analysis area).

Heliotrope Milkvetch (*Astragalus montii*)

Astragalus montii is the only Federally listed, threatened plant species on the Forest. Known habitat and population centers do occur within the analysis area, however this plant and its critical habitat is located outside of the proposed timber harvest units and would not be impacted by any of the sale activities.

LISTED SPECIES BIOLOGICAL ASSESSMENT SUMMARY OF CONCLUSIONS OF EFFECTS

Project Name: South Manti Timber Salvage Sales
Alternative: All Action Alternatives

Species	No Effect	May Effect, Not Likely To Adversely Affect	Likely To Adversely Affect	Beneficial Effects
Bald Eagle		X		
American Peregrine Falcon	X			
Southwestern Willow Flycatcher	X			
Heliotrope Milkvetch	X			
Canada Lynx		X		

VI. Rationale for the Summary of Conclusions of Effects

Bald Eagle (*Haliaeetus leucocephalus*)

The proposed timber harvesting "May Effect but is not likely to Adversely Affect" the viability of this bird for the following reasons:

- 1) Bald eagles could consume a treated gopher, however gopher control will utilize underground methods to prevent eagle and gopher interaction. Treatment of gophers will occur only where it is needed.
- 2) Helicopters may disrupt migrating bald eagles however, helicopter flights will not be allowed within 1/2 mile (line-of-sight) of areas where foraging eagles are found from October 1 through November 15.
- 3) Habitat areas for perching will be protected near lakes, reservoirs and ponds.
- 4) Foraging of the Bald Eagles in Castle Dale do not occur within National Forest System lands.

Southwest Willow Flycatcher (*Empidonax traillii extimus*)

The proposed timber harvesting will have **NO EFFECT** on the Southwestern Willow Flycatcher for the following reasons:

- 1) No harvesting activity will occur within any willow/riparian habitats.
- 2) The U.S. Fish and Wildlife Service species list indicates there are no Southwestern Willow Flycatchers within the analysis area.

Heliotrope Milkvetch (*Astragalus montii*)

The proposed timber harvesting will have **NO EFFECT** on Heliotrope Milkvetch for the following reasons:

- 1) No harvesting activity will occur within any known or potential habitat of this species.
- 2) Although this species is found within the analysis area, harvesting and road construction/reconstruction will not take place on or near any known populations on suitable habitat.

Canada Lynx (*Lynx canadensis*)

The proposed timber harvesting **"May Effect but is not likely to Adversely Affect"** the viability of this bird for the following reasons:

- 1) There is no evidence that lynx are currently found in the analysis area nor on the Wasatch Plateau.
- 2) Reforestation efforts would improve habitat for lynx prey species.
- 3) The analysis area is frequently used for winter recreation, to the point that it is very unlikely that lynx would be found in the area. Therefore, the additional disturbance caused by logging activities should make no or little difference to lynx that may be found in the area.
- 4) Because, there are no large contiguous blocks of forested areas in the analysis area specifically and the Wasatch Plateau in general, the Wasatch Plateau contains only marginal habitat.
- 5) The spruce bark beetle epidemic has greatly altered the habitat over thousands of acres creating a more open forest which limits the suitability of the habitat for lynx.

VII. CUMULATIVE EFFECTS

Past and present recreation activities have and will continue to impact wildlife populations and their habitats. Undeveloped and unauthorized roads and trails are created by Off Highway Vehicles (OHV). This has recently become a major concern because the effects result in many acres of lost foraging habitat (removal of herbaceous and browse species through soil compaction) and encroachment into wildlife security zones. Developed designated roads and trails, summer/fall camping, viewing, hiking, hunting, and bicycling all bring a large number of recreationists into the area most of the year. Perhaps the greatest recreational impact comes from big-game hunting. The lands located within and adjacent to the project area receive intensive use during the big-game hunting season. During the hunt, hunters and their camps can be found throughout the area. Wildlife are basically avoiding areas where humans are out competing the animals for space.

Past and present timber harvesting has decreased wildlife cover and security areas. Approximately 2000 acres have currently been harvested and a maximum of 4,000 acres are planned to be cut. Combined with the loss of vegetative cover and traffic use (recreation, logging), wildlife will avoid using areas.

Noxious weed invasion and aspen regeneration play an important ecological role within the project area. As more forest users interact with this local landscape, the risk of continual weed encroachment increases. Currently most thistle, white top and Canada Thistle are the dominant invaders within and adjacent to the analysis area. Acres of spread are increasing as human activities and natural dispersion continue. Weed control is difficult and is mostly addressed within Federal lands. These invaders slowly decrease the quality and quantity of the habitat many wildlife species depend on. On the Manti, and it is evident in some areas within the project area, quaking aspen lacks

regeneration due to conifer encroachment. The lack of aspen regeneration could result in habitat competition among wildlife species and domestic species utilizing the areas.

Spruce bark beetle outbreaks at epidemic levels quickly and at large landscape scales alter the habitat. These changes impact wildlife species both adversely and favorably. The spruce cover type has and is continuing to rapidly evolve from a closed overstory to more of an open overstory. This change should benefit those wildlife species dependant upon more open forest settings and negatively impact those species dependant upon a closed, interior forest settings. The effects, positive or negative, is the delay in time for the open forest character to occur and then evolve back to a closed overstory.

Although gas and coal activities are not directly involved within the analysis area, activities adjacent to the site at lower elevations can have indirect effects. As wildlife are displaced from forest actions within the analysis area, some will move into sites outside the project boundary where coal and gas activity are occurring. Mineral operations will alter vegetation through the removal of herbaceous and browse species and removal of large trees for pad and road construction. Again animals and plants are disturbed through either displacement or direct mortality. Although habitat reclamation efforts are typical efforts after mineral actions, deeds such as these add to the overall fragmentation of habitat within a time period.

Other forest use practices and natural events have affected wildlife habitat within and adjacent to the project area. Livestock grazing is a primary forest use that adds to the overall affect. Livestock will decrease forage and cover opportunities for wildlife and plants through competition. Habitat is altered through grazing resulting in further displacement of wildlife.

The total effects from the proposal relative to all present, past and foreseeable effects should not have harmful impacts upon the local threatened and endangered species provided all the planned designed features for the project are implemented. However, as future human actions increase, additional uses from all aspects like mining, recreation, grazing, fire suppression, etc. over space and time, the existing habitat will probably become less effective for those species Federally listed.

VII. DOCUMENTATION

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GLOSSARY

GLOSSARY

100 year floodplain - A land surface feature found in a river or stream valley bottom that is composed of stream deposited materials and, on average, is inundated with flood waters once every 100 years.

500 year floodplain - A land surface feature found in a river or stream valley bottom that is composed of stream deposited materials and, on average, is inundated with flood waters once every 500 years.

A

abiotic - Non-living. Climate is an abiotic component of ecosystems.

adaptive management - A type of natural resource management that implies making decisions as part of an on-going process. Monitoring the results of actions will provide a flow of information that may indicate the need to change a course of action. Scientific findings and the needs of society may also indicate the need to adapt resource management to new information.

aerial logging - Removing logs from a timber harvest area by helicopter. Fewer roads are required, so the impact to an area is minimized.

affected environment - The natural environment that exists at the present time in an area being analyzed.

age class - An age grouping of trees according to an interval of years, usually 20 years. A single age class would have trees that are within 20 years of the same age, such as 1-20 years or 21-40 years.

airshed - A geographic area that shares the same air.

allotment (range allotment) - The area designated for use by a prescribed number of livestock for a prescribed period of time. Though an entire Ranger District may be divided into allotments, all land will not be grazed, because other uses, such as recreation or tree planting, may be more important at a given time.

anadromous fish - Species of fish that mature in the sea and migrate into streams to spawn.

aspect - The direction a slope faces. A hillside facing east has an eastern aspect.

ASQ (allowable sale quantity) - The amount of timber that may be sold within a certain time period from an area of suitable land. The suitability of the land and the time period are specified in the Forest Plan.

attainment areas - Those areas which meet national air quality standards.

aquatic macroinvertebrates - Invertebrates living within aquatic systems that are large enough to be seen with the naked eye (e.g. most aquatic insects).

aquifer - A body of rock that is saturated with water or transmits water. When people drill wells, they tap water contained within an aquifer.

AUM (animal unit month) - The amount of dry forage required by one 1000 lb. cow for 1 month allocated at 26 pounds per day.

B

bark beetle - An insect that bores through the bark of forest trees to eat the inner bark and lay its eggs. Bark beetles are important killers of forest trees.

basal area - The area of the cross section of a tree trunk near its base, usually 4 and 1/2 feet above the ground. Basal area is a way to measure how much of a site is occupied by trees. The term basal area is often used to describe the collective basal area of trees per acre.

big game - Large mammals, such as deer, elk, and antelope that are hunted for sport.

biological control - The use of natural means to control unwanted pests. Examples include introduced or naturally occurring predators such as wasps, or hormones that inhibit the reproduction of pests. Biological controls can sometimes be alternatives to mechanical or chemical means.

biological diversity - The number and abundance of species found within a common environment. This includes the variety of genes, species, ecosystems, and the ecological processes that connect everything in a common environment.

biomass - The total weight of all living organisms in a biological community.

biome - The complex of living communities maintained by the climate of a region and characterized by a distinctive type of vegetation. Example of biomes in North America include the tundra, desert, prairie, and the western coniferous forests.

biota - The plant and animal life of a particular region.

biotic - Living. Green plants and soil microorganisms are biotic components of ecosystems.

BMP (Best Management Practices) - Practices designed to prevent or reduce water pollution. Also, referred to as Soil and Water Conservation Practices (SWCPs).

board foot - A measurement term for lumber or timber. It is the amount of wood contained in an unfinished board 1 inch thick, 12 inches long, and 12 inches wide.

broadcast burn - A prescribed fire that burns a designated area. These controlled fires can reduce wildfire hazards, improve forage for wildlife and livestock, or encourage successful regeneration of trees.

browse - Twigs, leaves, and young shoots of trees and shrubs that animals eat. Browse is often used to refer to the shrubs eaten by big game, such as elk and deer.

BTU - British Thermal Unit; the quantity of heat required to raise the temperature of one pound of water 1 degree Fahrenheit.

buffer - A land area that is designated to block or absorb unwanted impacts to the area beyond the buffer. Buffer strips along a trail could block views that may be undesirable. Buffers may be set aside next to wildlife habitat to reduce abrupt change to the habitat.

C

cable logging - Logging that involves the transport of logs from stump to collection points by means of suspended steel cables. Cable logging reduces the need for the construction of logging roads.

canopy - The part of any stand of trees represented by the tree crowns. It usually refers to the uppermost layer of foliage, but it can be used to describe lower layers in a multi-storied forest.

canopy cover - see cover class.

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capture (input)- one of the ways functions are described; resources (organisms, materials, and energy) brought into the system (i.e. photosynthesis, migration onto summer range, pollution brought in by wind or water).

cavity- A hole in a tree often used by wildlife species, usually birds, for nesting, roosting, and reproduction.

chemical control- The use of pesticides and herbicides to control pests and undesirable plant species.

class I areas - All international and national parks greater than 6,000 acres, and national wilderness areas greater than 5,000 acres which existed as of August 7, 1977. This class provides the most protection to pristine lands by severely limiting the amount of additional human-caused air pollution which can be added to these areas.

class II areas - All other areas of the county, unless upgraded to Class I. A greater amount of additional human-caused air pollution may be added to these areas. All Forest Service lands which are not designated as Class I are Class II.

class III areas - Areas having the least amount of regulatory protection from additional air pollution. To date, no Class III areas have been designated anywhere in the country.

clear cut- A harvest in which all or almost all of the trees are removed in one cutting.

climax- The culminating stage in plant succession for a given site. Climax vegetation is stable, self-maintaining, and self-reproducing.

coarse filter management- Land management that addresses the needs of all associated species, communities, environments, and ecological processes in a land area. (See line filter management.)

collector roads- These roads serve small land areas and are usually connected to a Forest System Road, a county road, or a state highway.

common (Class B) landscape- Areas where features contain variety in form, line, color, and texture or combinations thereof, but which tend to be common throughout the character type and are not outstanding in visual quality.

composition- What an ecosystem is composed of. Composition could include water, minerals, trees, snags, wildlife, soil, microorganisms, and certain plant species.

community- Is a somewhat contiguous vegetation in either quantitative or qualitative characteristic (plant community).

conifer- A tree that produces cones, such as a pine, spruce, or fir tree.

connected actions- Are actions which means that they are closely related and therefore should be discussed in the same impact statement.

connectivity (of habitats)- The linkage of similar but separated vegetation stands by patches, corridors, or "stepping stones" of like vegetation. This term can also refer to the degree to which similar habitats are linked.

consumptive use- Use of resources that reduces the supply, such as logging and mining.

contour- A line drawn on a map connecting points of the same elevation.

corridor- Elements of the landscape that connect similar areas. Streamside vegetation may create a corridor of willows and hardwoods between meadows where wildlife feed.

cover- Any feature that conceals wildlife or fish. Cover may be dead or live vegetation, boulders, or undercut streambanks. Animals use cover to escape from predators, rest, or feed.

cover class- Represents a percentage range for a fixed area covered by the crowns of plants. It is measured as a vertical projection of the outermost portion of the foliage. Cover class A = <40% canopy cover, cover class B = 40-60% canopy cover, cover class C = >60% canopy cover.

cover forage ratio- The ratio of hiding cover to foraging areas for wildlife species.

cover type (forest cover type)- Stands of a particular vegetation type that are composed of similar species. The aspen cover type contains plants distinct from the pinyon-juniper cover type.

created opening- An opening in the forest cover created by the application of even-aged silvicultural practices.

critical habitat- Areas designated for the survival and recovery of federally listed threatened or endangered species.

crown closure- see cover class.

crown height- The distance from the ground to the base of the crown of a tree.

cultural resource- The remains of sites, structures, or objects used by people in the past; this can be historical or pre-historic.

cumulative actions- Are actions which when viewed with other proposed actions have cumulatively significant impacts and should therefore be discussed in the same impact statement.

cumulative effects - Effects on the environment that result from separate, individual actions that, collectively, become significant over time.

cycling- One of the ways functions are described; resources which are transported within the system (i.e. animal migration, nutrient cycling in a forest stand, snow melt becoming part of the surface or groundwater flow).

D

dbh (diameter at breast height)- The diameter of a tree 4 and 1/2 feet above the ground on the uphill side of the tree.

decision criteria- The rules and standards used to evaluate alternatives to a proposed action on National Forest land. Decision criteria are designed to help a decision maker identify a preferred choice from the array of alternatives.

decking area- A site where logs are collected after they are cut and before they are taken to the landing area where they are loaded for transport.

DEIS (Draft Environmental Impact Statement)- The draft version of the Environmental Impact Statement that is released to the public and other agencies for review and comment.

desired future condition- Land or resource conditions that are expected to result if goals and objectives are fully achieved.

developed recreation- Recreation that requires facilities that, in turn, result in concentrated use of the area. For example, skiing requires ski lifts, parking lots, buildings, and roads. Campgrounds require roads, picnic tables, and toilet facilities.

direct effects- Which are caused by the action and occur at the same time and place. CFR 40 1508.8 (a).

dispersed recreation- Recreation that does not occur in a developed recreation site, such as hunting, backpacking, and scenic driving.

distinctive (Class A) landscape- Areas where features of landform, vegetative patterns, water forms, and rock formations are of unusual or outstanding visual quality.

disturbance- Any event, such as forest fire or insect infestations that alter the structure, composition, or functions of an ecosystem.

E

early forest succession- The biotic (or life) community that develops immediately following the removal or destruction of vegetation in an area. For instance, grasses may be the first plants to grow in an area that was burned.

ecological approach- An approach to natural resource management that considers the relationships among all organisms, including humans, and their environment.

ecology- The interrelationships of living things to one another and to their environment, or the study of these interrelationships.

ecoregion- An area over which the climate is sufficiently uniform to permit development of similar ecosystems on sites that have similar properties. Ecoregions contain many landscapes with different spatial patterns of ecosystems.

ecosystem- An arrangement of living and non-living things and the forces that move among them. Living things include plants and animals. Non-living parts of ecosystems may be rocks and minerals. Weather and wildfire are two of the forces that act within ecosystems.

ecosystem management- An ecological approach to natural resource management to assure productive, healthy ecosystems by blending social, economic, physical, and biological needs and values.

ecotone- The transition zone between two biotic communities, such as between the Ponderosa pine forest type and the mixed conifer forest, which is found at higher elevations than the pine.

ecotype- A population of a species in a given ecosystem that is adapted to a particular set of environmental conditions.

edge- The margin where two or more vegetation patches meet, such as a meadow opening next to a mature forest stand, or a ponderosa pine stand next to an aspen stand.

edge effect- The increased richness of plants and animals resulting from the mixing of two communities where they join.

element (of ecosystems)- An identifiable component, process, or condition of an ecosystem.

endangered species- A plant or animal that is in danger of extinction throughout all or a significant portion of its range. Endangered species are identified by the Secretary of the Interior in accordance with the Endangered Species Act of 1973.

endemic plant/organism- A plant or animal that occurs naturally in a certain region and whose distribution is relatively limited geographically.

environmental analysis- An analysis of alternative actions and their predictable long and short-term environmental effects. Environmental analyses include physical, biological, social, and economic factors.

environmental assessment- A brief version of an Environmental Impact Statement. (See Environmental Impact Statement.)

Environmental Impact Statement- A statement of environmental effects of a proposed action and alternatives to it. The EIS is released to other agencies and the public for comment and review.

ephemeral streams- Streams that flow only as the direct result of rainfall or snowmelt. They have no permanent flow.

erosion- The wearing away of the land surface by wind or water.

escape cover- Vegetation of sufficient size and density to hide an animal, or an area used by animals to escape from predators.

even aged management- Timber management actions that result in the creation of stands of trees in which the trees are essentially the same age.

eyrie- A ledge along a cliff used for nesting by peregrine falcons.

F

fauna- The animal life of an area.

forest development roads (FDR)- Roads that are part of the Forest development transportation system which includes existing and planned roads as well as other special and terminal facilities designated as Forest development transportation facilities, an existing road that is shown on the Forest Travel map and maintained for access.

felling- Cutting down trees.

final cut- The removal of the last seed bearers or shelter trees after regeneration of new trees has been established in a stand being managed under the shelterwood system of silviculture.

fine filter management- Management that focuses on the welfare of a single or only a few species rather than the broader habitat or ecosystem. (See coarse filter management.)

fire cycle- The average time between fires in a given area.

fire regime- The characteristics of fire in a given ecosystem, such as the frequency, predictability, intensity, and seasonality of fire.

fisheries habitat- Streams, lakes, and reservoirs that support fish, or have the potential to support fish.

flood plain- A lowland adjoining a watercourse. At a minimum, the area is subject to a 1% or greater chance of flooding in a given year.

flora- The plant life of an area.

forage- All browse and non-woody plants that are eaten by wildlife and livestock.

forb- A broadleaf plant that has little or no woody material in it.

foreground- The part of a scene or landscape that is nearest to the viewer.

forest cover type- See cover type.

Forest Vegetation Simulation- A computer model for timber growth and yield. It projects per acre growth and volume yield for commercial timber stands. Formerly known as "Prognosis".

forest health- A measure of the robustness of forest ecosystems. Aspects of forest health include biological diversity, soil, air, and water productivity, natural disturbances, and the capacity of the forest to provide a sustaining flow of goods and services for people.

Forest Development Roads and Trails- Roads and trails under the jurisdiction of the Forest Service.

Forest Supervisor- The official responsible for administering National Forest lands on an administrative unit, usually one or more National Forests. The Forest Supervisor reports to the Regional Forester.

fragmentation- The splitting or isolating of patches of similar habitat, typically forest cover, but including other types of habitat. Habitat can be fragmented naturally or from forest management activities, such as clearcut logging.

frost heave- A land surface that is pushed up by the accumulation of ice in the underlying soil.

fuel loading- Is the amount of tons per acre of down and dead woody material on a site. It can be further expressed in size categories and each category can then be expressed in tons per acre. Example 1/4" - 1" size class tons/acre or can be calculated as total tons per acre.

fuels- Plants and woody vegetation, both living and dead, that are capable of burning.

fuels management- The treatment of fuels that would otherwise interfere with effective fire management or control. For instance, prescribed fire can reduce the amount of fuels that accumulate on the forest floor before the fuels become so heavy that a natural wildfire in the area would be explosive and impossible to control.

fuelwood- Wood cut into short lengths for burning.

function- All the processes within an ecosystem through which the elements interact, such as succession, the food chain, fire, weather, and the hydrologic cycle.

G

game species- Any species of wildlife or fish that is harvested according to prescribed limits and seasons.

geomorphic processes- Processes that change the form of the earth, such as volcanic activity, running water, and glacial action.

geomorphology- The science that deals with the relief features of the earth's surface.

GIS (geographic information systems)- GIS is both a database designed to handle geographic data as well as a set of computer operations that can be used to analyze the data. In a sense, GIS can be thought of as a higher order map.

ground-based yarding- A self-propelled vehicle used to transport logs, generally by dragging them with a grapple or choker.

ground fire- A fire that burns along the forest floor and does not affect trees with thick bark or high crowns.

ground water- The supply of fresh water under the earth's surface in an aquifer or in the soil.

group selection- A method of tree harvest in which trees are removed periodically in small groups. This silvicultural treatment results in small openings that form mosaics of age class groups in the forest.

H

habitat- The area where a plant or animal lives and grows under natural conditions.

habitat capability- The ability of a land area or plant community to support a given species of wildlife.

habitat diversity- A number of different types of wildlife habitat within a given area.

habitat diversity index- A measure of improvement in habitat diversity.

habitat type- A way to classify land area. A habitat type can support certain climax vegetation, both tree and undergrowth species. Habitat typing can indicate the biological potential of a site.

helicopter yarding- The removal of timber by a helicopter lifting the logs above the remaining canopy and flying the logs to a landing.

hiding area/cover- Vegetation capable of hiding 90% of an adult elk or deer from human's view at a distance of 200 feet or less.

historic- For this document, historic refers to time after people who recorded history through written records, generally Euro Americans, entered the area.

horizontal diversity- The distribution and abundance of different plant and animal communities or different stages of plant succession across an area of land, the greater the numbers of communities in a given area, the higher the degree of horizontal diversity.

hydrologic cycle- Also called the water cycle, this is the process of water evaporating, condensing, falling to the ground as precipitation, and returning to the ocean as run-off.

hydrology- The science dealing with the study of water on the surface of the land, in the soil and underlying rocks, and in the atmosphere.

I

indicator species- A plant or animal species related to a particular kind of environment. Its presence indicates that specific habitat conditions are also present.

indigenous (species)- Any species of wildlife native to a given land or water area by natural occurrence.

Indirect effects- Are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. (CFR 40.1508.8 (b)).

Individual tree selection- The removal of individual trees from certain size and age classes over an entire stand area. Regeneration is mainly natural, and an uneven aged stand is maintained.

Induced edge- an edge that results from the meeting of two successional stages or vegetative conditions within a plant community. These can be created by disturbance (i.e. grazing, timber harvest, fire, insect outbreaks).

Inherent edge- an edge that results from the meeting of two plant community types. These often result from abrupt changes in soil type, topographic differences, geomorphic differences, and changes in microclimate.

Instream flow- The quantity of water necessary to meet seasonal stream flow requirements to accomplish the purposes of the National Forests, including, but not limited to fisheries, visual quality, and recreational opportunities.

Integrated pest management- IPM evaluates alternatives for managing forest pest populations, based on consideration of pest-host relationships.

interdisciplinary team- A team of individuals with skills from different disciplines that focuses on the same task or project.

Intermediate cut- The removal of trees from a stand sometime between the beginning or formation of the stand and the regeneration cut. Types of intermediate cuts include thinning, release, and improvement cuttings.

Intermittent stream- A stream that flows only at certain times of the year when it receives water from streams or from some surface source, such as melting snow.

Intermountain Region- The portion of the USDA Forest Service, also referred to as Region Four, that includes National Forests in Utah, Nevada, southern Idaho, and southwestern Wyoming.

irretrievable- One of the categories of impacts mentioned in the National Environmental Policy Act to be included in statements of environmental impacts. An irretrievable effect applies to losses of production or commitment of renewable natural resources. For example, while an area is used as a ski area, some or all of the timber production there is irretrievably lost. If the ski area closes, timber production could resume; the loss of timber production during the time that the area was devoted to winter sports is irretrievable. However, the loss of timber production during that time is not irreversible, because it is possible for timber production to resume if the area is no longer used as a ski area.

irreversible- A category of impacts mentioned in statements of environmental impacts that applies to non-renewable resources, such as minerals and archaeological sites. Irreversible effects can also refer to effects of actions that can be renewed only after a very long period of time, such as the loss of soil productivity.

J

Jammer- A lightweight ground lead yarder using tongs and usually mounted on a truck with a spar and boom.

K

key summer range- The portion of a wildlife species' summer range that is essential for the animal's pre, post, and reproduction cycles. Deer require "lawning areas" where does give birth and hide their fawns for an essential period of time in the spring.

key winter range- That portion of big game's range where the animals find food and cover during severe winter weather.

L

ladder fuels- Vegetation located below the crown level of forest trees which can carry fire from the forest floor to tree crowns. Ladder fuels may be low growing tree branches, shrubs, or smaller trees.

lagamorphs- Hares and rabbits.

land class- The topographic relief of a unit of land. Land classes are separated by slope; this coincides with the timber inventory process. The three land classes used in the Forest Plan are defined by the following slope ranges: 0 to 35 percent, 36 to 55 percent, and greater than 55 percent.

landing- Any place where cut timber is assembled for further transport from the timber sale area.

landline- The boundary lines for National Forest land.

landscape- A large land area composed of interacting ecosystems that are repeated due to factors such as geology, soils, climate, and human impacts. Landscapes are often used for coarse grain analysis.

Landslide Events: Low frequency/high magnitude- Infrequent landslide events that occur over a regional (high magnitude) rather than localized area caused by high precipitation cycles (low frequency), usually two or more consecutive years of above average annual precipitation and snowpack. The above average wet cycles typically cause saturation of perched water bearing zones and regolith (unconsolidated materials including soil) and flooding during spring snowmelt/runoff in widespread areas. These conditions cause numerous landslides in geologically unstable areas.

Landslide Events: High frequency/low magnitude- Localized (low magnitude) landslides or landslide events which typically occur during average or below average precipitation years or cycles. They are typically caused by earthquakes or localized changes in geologic conditions (topography, drainage patterns, ground moisture, slope support mechanisms) due to natural processes or man's activities. They are considered to be high frequency because they are not restricted to low frequency high precipitation cycles.

land use planning- The process of organizing the use of lands and their resources to best meet people's needs over time, according to the land's capabilities.

late forest succession- The stage of forest succession in which most of the trees are mature or overmature.

level 1- (see maintenance level 1)

life zone- Areas or "belts" of land that have distinct plant and animal characteristics determined by elevation, latitude, and climate. When ascending a high mountain, you will pass through these life zones. Examples of life zones include the Upper Sonoran, where Cedar City is located and grama grasses, sagebrush, and scattered piñon juniper predominate, and the Transition zone, where Ponderosa pine is predominant.

litter (forest litter)- The freshly fallen or only slightly decomposed plant material on the forest floor. This layer includes foliage, bark fragments, twigs, flowers, and fruit.

logging residue (slash)- The residue left on the ground after timber cutting. It includes unutilized logs, uprooted stumps, broken branches, bark, and leaves. Certain amounts of slash provide important ecosystem roles, such as soil protection, nutrient cycling, and wildlife habitat.

M

M- Thousand. Five thousand board feet of timber can be expressed as 5M board feet.

macro climate- The general, large scale climate of a large area, as distinguished from the smaller scale micro climates within it.

maintenance level 1- Level of maintenance assigned to intermittent service roads during the time they are closed to vehicular traffic. The closure period must exceed 1 year. Basic custodial maintenance is performed to keep damage to adjacent resources to an acceptable level and perpetuate the road to facilitate future management activities. Emphasis is normally given to maintaining drainage facilities and runoff patterns. Planned road deterioration may occur at this level. Appropriate traffic management strategies are "prohibit" and "eliminate." (F 57.709.58.10 p. 4).

management action- Any activity undertaken as part of the administration of the National Forest.

mass movement/wasting- The down-slope movement of large masses of earth material by the force of gravity. Also called a landslide.

matrix- The least fragmented, most continuous pattern element of a landscape; the vegetation type that is most continuous over a landscape.

mature timber- Trees that have attained full development, especially height, and are in full seed production.

MBF- Thousand Board Feet (see board feet.)

mean annual increment of growth- The total increase in size or volume of individual trees. Or, it can refer to the increase in size and volume of a stand of trees at a particular age, divided by that age in years.

mean annual precipitation - the average amount of rain and snow (expressed in inches) that falls on an area.

mean annual water yield - (see water yield)

microclimate- The climate of a small site. It may differ from the climate at large of the area due to aspect, tree cover (or the absence of tree cover), or exposure to winds.

middleground- A term used the management of visual resources, or scenery. It refers to the visible terrain beyond the foreground where individual trees are still visible but do not stand out distinctly from the stand.

mineral soil- Soil that consists mainly of inorganic material, such as weathered rock, rather than organic matter.

MIS (management indicator species)- A wildlife species whose population will indicate the health of the ecosystem in which it lives and, consequently, the effects of forest management activities to that ecosystem. MIS species are selected by land management agencies. (See "indicator species".)

mission (of the USDA Forest Service)- "To Care for the Land and Serve the People". As set forth in law, the mission is to achieve quality land management under the sustainable multiple-use management concept to meet the diverse needs of people.

mitigation- Actions taken to avoid, minimize, or rectify the impact of a land management practice.

mixed stand- A stand consisting of two or more tree species.

MMBF- Million Board Feet (See board feet.)

modification- A visual quality objective; management activities may visually dominate the original characteristic landscape, but they must borrow from naturally established form, line, color, or texture so that the activity blends with the surrounding area.

monitoring and evaluation- The periodic evaluation of forest management activities to determine how well objectives were met and how management practices should be adjusted. See "adaptive management".

mortality- Trees that were merchantable and have died within a specified period of time. The term mortality can also refer to the rate of death of a species in a given population or community.

mosaic- Areas with a variety of plant communities over a landscape, such as areas with trees and areas without trees occurring over a landscape.

mountain pine beetle- A tiny black insect, ranging from 1/8 to 3/4 inch in size, that bores through a pine tree's bark. It stops the tree's intake and transport of the food and nutrients it must have to stay alive, thus killing the tree.

multiple use management- The management of all the various renewable surface resources of National Forest lands for a variety of purposes such as recreation, range, timber, wildlife and fish habitat, and watershed.

National Park Service- The agency of the US Department of the Interior responsible for the administration of National Parks, Monuments, and Historic Sites. It is distinct from the USDA Forest Service both administratively and by mission.

natural barrier- A natural feature, such as a dense stand of trees or downfall, that will restrict animal travel.

natural disturbance- See disturbance.

natural range of variability- See range of variability

natural resource- A feature of the natural environment that is of value in serving human needs.

NEPA (National Environmental Policy Act) - Congress passed NEPA in 1969 to encourage productive and enjoyable harmony between people and their environment. One of the major tenets of NEPA is its emphasis on public disclosure of possible environmental effects of any major action on public lands. Section 102 of NEPA requires a statement of possible environmental effects to be released to the public and other agencies for review and comment.

neotropical migratory birds- Are species that nest and raise young in North America and migrate to tropical areas in Mexico, the Caribbean, and Central and South America in the winter.

nest survey- A way to estimate the size of a bird population by counting the number of nests in a given area.

NFLRMP (National Forest Land and Resource Management Plan) - Also called the Forest Plan or just the Plan, this document guides the management of a particular National Forest and establishes management standards and guidelines for all lands of that National Forest.

NFMA (National Forest Management Act) - This law was passed in 1976 and requires the preparation of Regional Guides and Forest Plans.

NFRS- National Forest recreation sites that have been inventoried.

No Action alternative- The most likely condition expected to exist in the future if management practices continue unchanged.

nonattainment areas - Those areas which do not meet national air quality standards

noncommercial vegetative treatment- The removal of trees for reasons other than timber production.

nonconsumptive use- The use of a resource that does not reduce the supply. For instance, bird watching is a non-consumptive use of wildlife. Boating and fishing are non-consumptive uses of water

nongame- Wildlife species that are not hunted for sport.

nonpoint source pollution- Pollution whose source is not specific in location. The sources of the discharge are dispersed, not well defined, or constant. Rain storms and snowmelt often make this type of pollution worse. Examples include sediments from logging activities and runoff from agricultural chemicals.

non-project roads- Roads not needed for future management of forest resources adjacent to the treatment areas.

non-renewable resource- A resource whose total quantity does not increase measurably over time, so that each use of the resource diminishes the supply.

nonssystem roads- User-created roads developed over time and not referenced on the 1991 Forest Travel Plan.

notice of intent- A notice in the federal register of intent to prepare an environmental impact statement or a proposed action.

noxious weed- Is a plant that is extremely prolific, invasive, competitive, harmful, destructive and difficult to control.

nutrient cycle- The circulation of chemical elements and compounds, such as carbon and nitrogen, in specific pathways from the non-living parts of ecosystems into the organic substances of the living parts of ecosystems, and then back again to the non-living parts of the ecosystem. For instance, nitrogen in wood is returned to the soil as the dead tree decays; the nitrogen again becomes available to living organisms in the soil, and upon their death, the nitrogen is available to plants growing in that soil.

O

obliteration - see road reclamation.

old growth- Old forests often containing several canopy layers, variety in tree sizes and species, decadent old trees, and standing and dead woody material.

Organic soil- Soil at least partly derived from living matter, such as decayed plant material.

ORV- Off-road vehicles, such as motor cycles, 4-wheel drive vehicles, and 4-wheelers.

output- one of the ways functions are described; resources which leave a system (i.e. animals migrating out of an area, mass erosion, removal of commercial timber from an area).

overmature timber- Trees that have attained full development, particularly in height, and are declining in vigor, health, and soundness.

overstory- The upper canopy layer; the plants below comprise the understory.

P

paleontological resources- Of or belonging to the fossil record, either plant or animal, including fossils of large mammals belonging to the Late Quaternary geologic period which have previously been found in the general region. Paleontological resources are also nonrenewable.

parent material- The mineral or organic matter from which the upper layers of soil are formed.

park-like structure- Stands with large scattered trees and open growing conditions, usually maintained by ground fires.

partial retention- A visual quality objective which, in general, means human activities may be evident, but must remain subordinate to the characteristic landscape.

patch- An area of homogeneous vegetation, in structure and composition.

patch cut- A clearcut that creates small openings in a stand of trees, usually between 15 and 40 acres in size. On the Dixie National Forest and elsewhere, patch cuts are used to provide the disturbance needed to regenerate aspen.

percolation- Downward flow or infiltration of water through the pores or spaces of rock or soil.

perennial stream- A stream that flows throughout the year and from source to mouth.

permitted grazing- Grazing on a National Forest range allotment under the terms of a grazing permit.

personal use- The use of a forest product, such as firewood, for home use and not for commercial use.

persons-at-one-time (PAOT)- A recreation capacity measurement term indicating the number of people who can use a facility or area at one time.

planning area- The area of National Forest land covered by a Regional Guide or Forest Plan.

planning period- The 50 year time frame for which goods, services, and effects were projected in the development of the Forest Plan.

pole/sapling- The stage of forest succession in which trees are between 3 and 7 inches in diameter and are the dominant vegetation.

pole timber- Trees at least 5 inches in diameter, but smaller than the minimum size for sawtimber.

PNV- See present net value.

precommercial thinning- Removing some of the trees from a stand that are too small to be sold for lumber or house logs, so the remaining trees will grow faster.

predator- An animal that lives by preying on other animals. Predators are at or near the tops of food chains.

pre-existing use- Land use that may not conform to a zoning ordinance but existed prior to the enactment of the ordinance.

prehistoric- Relating to time prior to written record. However, during this time a form of recording known as "rock art" or pictographs and petroglyphs, were made by indigenous peoples in this region. Because rock art has not been interpreted, it is not formally recognized as "written record".

preparatory cut- The removal of trees near the end of a rotation to open the canopy so the crowns of seed bearing trees can enlarge. This improves seed production and encourages natural regeneration. (See rotation.)

prescribed fire- Fire set intentionally in wildland fuels under prescribed conditions and circumstances. Prescribed fire can rejuvenate forage for livestock and wildlife or prepare sites for natural regeneration of trees.

prescription- Management practices selected to accomplish specific land and resource management objectives.

present net value (PNV), also called present net worth- The measure of the economic value of a project when costs and revenues occur in different time periods. Future revenues and costs are "discounted" to the present by an interest rate that reflects the changing value of a dollar over time. The assumption is that dollars today are more valuable than dollars in the future. PNV is used to compare project alternatives that have different cost and revenue flows.

presuppression- Activities carried out in advance of fire occurrence to ensure effective suppression when the need arises.

primitive ROS (Recreation Opportunity Spectrum)- A classification of wilderness and recreation opportunity. It is characterized by an essentially unmodified environment, where trails may be present but structures are rare, and where it is highly probable to be isolated from the sights and sounds of people. (See ROS.)

production- one of the ways functions are described; resources which are "manufactured" within the system (i.e. plant growth, animal reproduction, snags falling and becoming down woody material).

productive- The ability of an area to provide goods and services and to sustain ecological values.

project roads- Roads needed in support of timber salvage activities and not needed for future management of forest resources within the analysis area.

public domain- The territory ceded to the Federal government by the original thirteen states, plus additions by treaty, cession, and purchase.

public land- Land for which title and control rests with a government—Federal, state, regional, county, or municipal.

public involvement- The use of appropriate procedures to inform the public, obtain early and continuing public participation, and consider the views of interested parties in planning and decision making.

Q

quadratic mean diameter (QMD)- indicates the diameter of the cross-section of average area. This number is used for determining basal area and volume.

R

range- Land on which the principle natural plant cover is composed of native grasses, forbs, and shrubs that are valuable as forage for livestock and big game.

range management- The art and science of planning and directing range use intended to yield the sustained maximum animal production and perpetuation of the natural resources.

range of variability (Also called the historic range of variability or natural range of variation)- The components of healthy ecosystems fluctuate over time. The range of sustainable conditions in an ecosystem is determined by time, processes (such as fire), native species, and the land itself. For instance, ecosystems that have a 10 year fire cycle have a narrower range of variation than ecosystems with 200-300 year fire cycle. Past management has placed some ecosystems outside their range of variability. Future management should move such ecosystems back toward their natural, sustainable range of variation.

Ranger District- The administrative sub-unit of a National Forest that is supervised by a District Ranger who reports directly to the Forest Supervisor.

raptor- A bird of prey, such as an eagle or hawk.

RARE II- Roadless Area Review and Evaluation. The national inventory of roadless and undeveloped areas within the National Forests and Grasslands.

recharge- The addition of water to ground water by natural or artificial processes.

recreation visitor days (RVD)- Twelve visitor hours, which may be aggregated continuously, intermittently, or simultaneously by one or more persons.

reforestation- The restocking of an area with forest trees, by either natural or artificial means, such as planting.

regeneration- The renewal of a tree crop by either natural or artificial means. The term is also used to refer to the young crop itself.

Regional Forester- The official of the USDA Forest Service responsible for administering an entire region of the Forest Service.

release cutting- Removal of competing vegetation to allow desired tree species to grow.

removal cut- The removal of the last seed bearers or shelter trees after regeneration is established.

residual stand- The trees remaining standing after an event such as selection cutting.

resilience- The ability of an ecosystem to maintain diversity, integrity, and ecological processes following a disturbance.

resilock- Means to reforest a unit or area with trees or shrubs.

responsible official- The Forest Service employee who has been delegated the authority to carry out a specific planning action.

restoration (of ecosystems)- Actions taken to modify an ecosystem to achieve a desired, healthy, and functioning condition.

retention- A visual quality objective, management activities are not visually evident; activities repeat form, line, color, and texture characteristics found in the landscape.

revegetation- The re-establishment and development of a plant cover by either natural or artificial means, such as re-seeding.

riparian area- The area along a watercourse or around a lake or pond.

riparian ecosystem- The ecosystems around or next to water areas that support unique vegetation and animal communities as a result of the influence of water.

ROD- Record of Decision. A official document in which a deciding official states the alternative that will be implemented from a prepared EIS.

ROS- Recreation Opportunity Spectrum. The land classification system that categorizes land by its setting and the probable recreation experiences and activities it affords.

road construction- Investment in construction of a road to provide access that adds new miles of road to the transportation system.

road reconstruction- The investment in construction activity that results in betterment, restoration, or in the realignment of a road.

road reclamation- The restoration of a roadway to non-roads as by a number of methods.

rotation- The number of years required to establish and grow timber crops to a specified condition of maturity.

roundwood- Timber and fuelwood prepared in the round state, such as house logs and telephone poles.

run-off- The portion of precipitation that flows over the land surface or in open channels.

S

sacrifice area/site- In range management, a site allowed to be overgrazed to obtain efficient overall use of the management area. In cultural resource management, it may refer to a site intentionally sacrificed to extensive public use in order to preserve the larger cultural area.

salvage harvest- Harvest of trees that are dead, dying, or deteriorating because they are overmature or have been materially damaged by fire, wind, insects, fungi, or other injurious agents, before the wood becomes unmerchantable.

sanitation harvest- The harvest of dead, damaged or susceptible trees done primarily to prevent the spread of pests or disease and to promote forest health.

sapling- A loose term for a young tree more than a few feet tall and an inch or so in diameter that is typically growing vigorously.

sawtimber- Trees that are 9 inches in diameter at breast height or larger that can be made into lumber.

scale- In ecosystem management, it refers to the degree of resolution at which ecosystems are observed and measured.

scoping- The ongoing process to determine public opinion, receive comments and suggestions, and determine issues during the environmental analysis process. It may involve public meetings, telephone conversations, or letters.

second growth- Forest growth that was established after some kind of interference with the previous forest crop, such as cutting, fire, or insect attack.

seed tree harvest- Removal of the mature timber crop from an area in one cut, except for a certain number of seed bearers.

sensitive species- Plant or animal species which are susceptible to habitat changes or impacts from activities. The official designation is made by the USDA Forest Service at the Regional level and is not part of the designation of Threatened or Endangered Species made by the US Fish and Wildlife Service.

seral- The stage of succession of a plant or animal community that is transitional. If left alone, the seral stage will give way to another plant or animal community that represents a further stage of succession.

shelterwood- A cutting method used in a more or less mature stand, designed to establish a new crop under the protection of the old.

silvicultural system- The cultivation of forests; the result is a forest of a distinct form. Silvicultural systems are classified according to harvest and regeneration methods and the type of forest that results.

significant issue- Relate to a proposed action and must be analyzed in depth in the environmental impact statement.

silviculture- The art and science that promotes the growth of single trees and the forest as a biological unit.

single tree selection- See individual tree selection.

site preparation- The general term for removing unwanted vegetation, slash, roots, and stones from a site before reforestation. Naturally occurring wildfire, as well as prescribed fire can prepare a site for natural regeneration.

site sensitivity area- Defined as high, moderate, or low based on the probability that they might contain cultural resources.

site-specific- refers to designing an appropriate action on a case by case basis. Conditions on the ground are variable and a treatment is specifically designed based on the unique condition of the treatment site.

size class- One of the three intervals of tree stem diameters used to classify timber in the Forest Plan data base. The size classes are Seeding/Sapling (less than 5 inches in diameter), Pole Timber (5 to 7 inches in diameter), Sawtimber (greater than 7 inches in diameter)

skidding- Hauling logs by sliding, not on wheels, from stump to a collection point.

skid trail- narrow path on which logging equipment travel when moving logs from the forest to a designated landing location.

skier days- Twelve skier hours, which may be aggregated continuously, intermittently, or simultaneously by one or more persons.

skyline logging- A logging system used to remove timber from steep slopes. Logs are brought up-slope on a suspended cable, or skyline. Since the weight of the log is completely or partially supported by the cable, there is little disturbance to soil or other vegetation.

slash- The residue left on the ground after timber cutting or left after a storm, fire, or other event. Slash includes unused logs, uprooted stumps, broken or uprooted stems, branches, bark, etc.

slump- A landslide where the underlying rock masses tilt back as they slide from a cliff or escarpment.

small game- Birds and small animals normally hunted or trapped.

snag- A standing dead tree. Snags are important as habitat for a variety of wildlife species and their prey.

soil compaction- The reduction of soil volume. For instance, the weight of heavy equipment on soils can compact the soil and thereby change it in some ways, such as in its ability to absorb water.

soil productivity- The capacity of a soil to produce a specific crop. Productivity depends on adequate moisture and soil nutrients, as well as favorable climate.

sound wood- Timber that is in solid, whole, good condition. Sound wood is free from damage, decay, or defects.

special use permit- A permit issued to an individual or group by the USDA Forest Service for use of National Forest land for a special purpose. Examples might be a Boy Scout Jamboree or a mountain bike race.

stand- A group of trees that occupies a specific area and is similar in species, age, and condition.

stand density index (SDI)- The index number is the number of trees per acre at an average stand diameter of 10 inches. This index changes for different species, since some trees are more shade tolerant than others (i.e. the maximum trees per acre for Engelmann spruce-subalpine fir stand is 670 and for ponderosa pine is 450).

standards and guidelines- Requirements found in a Forest Plan which impose limits on natural resource management activities, generally for environmental protection.

stewardship- Caring for the land and its resources to pass healthy ecosystems to future generations.

stocking level- The number of tree in an area as compared to the desirable number of trees for best results, such as maximum wood production.

storage- one of the ways functions are described; resources which are conserved within the system (i.e. sediments and water retained in wetlands, carbon and other nutrient storage in down woody material).

stringer- A strip of vegetation different from surrounding vegetation, such as a stringer of aspen in an area of spruce.

structure- How the parts of ecosystems are arranged, both horizontally and vertically. These parts include vegetation patches, edge, fragmentation, canopy layers, snags, down wood, steep canyons, rocks in streams, and roads. For example, structure might reveal a pattern, or mosaic, or total randomness of vegetation.

suitability- The appropriateness of certain resource management to an area of land. Suitability can be determined by environmental and economic analysis of management practices.

successional stage - A stage of development of a plant community as it moves from bare ground to climax. The grass-forb stage of succession precedes the woody shrub stage.

succession- The natural replacement, in time, of one plant community with another. Conditions of the prior plant community (or successional stage) create conditions that are favorable for the establishment of the next stage.

surface resources- Renewable resources that are on the surface of the earth, such as timber and forage, in contrast to ground water and minerals which are located beneath the surface.

sustainability- The ability of an ecosystem to maintain ecological processes and functions, biological diversity, and productivity over time.

sustainable- The yield of a natural resource that can be produced continually at a given intensity of management is said to be sustainable.

sustained yield- The yield that a renewable resource can produce continuously at a given intensity of management.

Soil and Water Conservation Practices (SWCPs)- Refer to BMPs.

system road- Roads that are part of the Forest development transportation system. (see forest development roads)

T target- A National Forest's annual goals for accomplishment for natural resource programs. Targets represent the commitment the Forest Service has with Congress to accomplish the work Congress has funded, and are often used as a measure of the agency's performance.

thermal cover- Cover used by animals against weather. For elk, thermal cover can be found in a stand of coniferous trees at least 40 feet tall with a crown closure of at least 70%.

thinning- A cutting made in an immature stand of trees to accelerate growth of the remaining trees or to improve the form of the remaining trees.

threatened species- Those plant or animal species likely to become endangered throughout all or a specific portion of their range within the foreseeable future as designated by the U.S. Fish and Wildlife Service under the Endangered Species Act of 1973.

timber classification- The classification of forested lands into land management alternatives according to how the land relates to management of the timber resource there.

tractor logging- A logging method that uses tractors to carry or drag logs from the stump to a collection point.

treatment area- The site- specific location of a resource improvement activity.

tree opening- An opening in the forest created by even-aged silvicultural practices.

TSI (Timber Stand Improvement)- Actions to improve growing conditions for trees in a stand, such as thinning, pruning, prescribed fire, or release cutting.

type conversion- The conversion of the dominant vegetation in an area from forested to non-forested or from one species to another.

U underburn- A burn by a surface fire that can consume ground vegetation and "ladder" fuels.

understory- The trees and woody shrubs growing beneath the overstory in a stand of trees.

uneven-aged management - Actions that maintain a forest or stand of trees composed of intermingling trees that differ markedly in age. Cutting methods that develop and maintain uneven-aged stands are single-tree selection and group selection.

unregulated harvest- Tree harvest that is not part of the allowable sale quantity (ASQ). It can include the removal of cull or dead material or non-commercial species. It also includes volume removed from non-suitable areas for research, to meet objectives other than timber production (such as wildlife habitat improvement), or to improve administrative sites (such as campgrounds).

unsuitable lands- Forest land that is not managed for timber production. Reasons may be matters of policy, ecology, technology, silviculture, or economics.

use, allowable- An estimate of proper range use. Forty to fifty percent of the annual growth is often used as a rule of thumb on ranges in good to excellent condition. It can also mean the amount of forage planned to be used to accelerate range rehabilitation.

V variety class- A way to classify landscapes according to their visual features. This system is based on the premise that landscapes with the greatest variety or diversity have the greatest potential for scenic value.

vegetation management- Activities designed primarily to promote the health of forest vegetation for multiple-use purposes.

vegetation type- A plant community with distinguishable characteristics.

vegetative structural stage- A method of describing the growth stages of a stand of living trees. It is based on tree size (DBH: diameter at breast height) and total canopy cover. The stages are: Grass-forb-shrub (VSS 1) = 0-1 inch DBH; Seedling/sapling (VSS 2) = 1-5 inches DBH; Young Forest (VSS 3) = 5-12 inches DBH; Mid-Aged Forest (VSS 4) = 12-18 inches DBH; Mature Forest (VSS 5) = 18-24 inches DBH; Old Forest (VSS 6) = 24+ inches DBH.

vertical diversity- The diversity in a stand that results from the different layers or tiers of vegetation.

visible population- The number of individuals of a species sufficient necessary to ensure the long-term existence of the species in natural, self-sustaining populations, adequately distributed throughout its range.

virgin forest- A natural forest virtually uninfluenced by human activity.

visual quality objective- A set of measurable goals for the management of forest visual resources used to measure the amount of visual contrast with the natural landscape caused by human activities.

visual resource- A part of the landscape important for its scenic quality. It may include a composite of terrain, geologic features, or vegetation.

W

watershed- The entire region drained by a waterway (or into a lake or reservoir. More specifically, a watershed is an area of land above a given point on a stream that contributes water to the streamflow at that point.

water table- The upper surface of groundwater. Below it, the soil is saturated with water.

water yield- The runoff from a watershed, including ground water outflow. Mean annual water yield is the amount of water that flows from the area and appears in streams expressed in area-inches. Two area-inches over 1 acre would equal 2 acre-inches.

wetlands- Areas that are permanently wet or are intermittently covered with water.

wilderness (Wilderness Area)- Undeveloped federal land retaining its primeval character, without permanent human habitation or improvements. It is protected and managed to preserve its natural condition. Wilderness Areas are designated by Congress.

wildfire- Any wildland fire that is not a prescribed fire.

wildlife habitat diversity- The distribution and abundance of different plant and animal communities and species within a specific area.

windthrow- Trees uprooted by wind.

wood fiber production- The growing, tending, harvesting, and regeneration of harvestable trees.

woodland products- Harvestable items from pinyon-juniper woodlands. These include fuelwood, posts, pine nuts and Christmas trees.

Y

yarding- Moving the cut trees from where they fell to a centralized place (landing) for hauling away from the stand.

Z

Zone of influence - The area influenced by Forest Service management activities.

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This list of terms is intended to assist the reader in locating a broad scope of subject areas discussed in this document. The reference to specific page numbers is not intended to be complete.

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